TELEPHONE ENGINEER

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WHY NOT TELL YOUR TROUBLES?

There is a peculiar kink in the mental make-up of some telephone men that makes them take the attitude that the public should be kept in ignorance of trouble and damages that occur to telephone systems. It is supposed to be kept a deep, dark secret that wires and poles break down when loaded with a half-inch of sleet, and that lightning and wind storms cause crossed wires and grounded lines.

A hundred lines may be out of service and the repair forces may labor at top speed from dawn till after dark to get them working again, and yet there will be no admission or statement from the management that any trouble has occurred; for, if an admission is unavoidable, the damage will be minimized.

The public, generally, knows when such damage occurs and does not expect the impossible in making repairs but John Doe and his neighbors are likely to do a lot of plain and fancy kicking when they are left to understand that only a small amount of trouble occurred—and yet their lines were left out of service for twenty-four hours or longer.

It seems to us that the better way is to admit frankly that lines sometimes do fail and that it takes a certain amount of time and strenuous efforts to make repairs. When the number of lines affected is large, special effort should be made to inform the public of the conditions and to assure them that repairs will be made as quickly as possible. We know one telephone manager who makes it his business to learn of all the damage that is done by a storm not only to telephone lines but to electric lines, railroads, buildings, roads and live stock. He then prepares a story for the local paper which has a real news interest and which puts over the story of the telephone damage without having it bear the mark of company propaganda.

EMPHASIZE THE VALUE OF SERVICE

In our contemporary, "Electrical Merchandising," we find an editorial that may be modified to have application in the telephone field. The editorial writer is making a plea for the selling of the idea that electrical appliances and service are something of a luxury as well as a necessity. He points out that the housewife will economize in the use of electricity by turning out every light not actively in use and by reducing the use of other electrical conveniences and yet will approve the buying of a closed car instead of an open model, when a new automobile is to be purchased.

The reason, he avers, is that electric service is regarded as a necessity and its use is, therefore, to be economized while the car is a luxury and, as such, will be indulged to the extent of the ability of the owner to pay. If the convenience features were emphasized more by electrical salesmen and the necessity features less, the use of electrical appliances might be made to take on the aspect of a luxury and their sale and use promoted thereby.

It seems that there is something of the same thing to be said in respect to telephone service. The necessity of telephone service and the cost of service have been emphasized to the point where people regard the service as something that can not be done without but, by reason of the very fact that it is a necessity, one which should be purchased at as low cost as possible. It seems that we have come to the place where we could lay emphasis on the convenience and value of telephone service rather than its necessity and cost.

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PROPER RATE DIFFERENTIALS

In a very interesting paper, before the last convention of the United States Independent Telephone Association, Mr. R. F. Wilder, General Commercial Superintendent of the Tri-State Telephone and Telegraph Co., laid down the following principle in regard to the differentials that should exist between the rates for various classes of service: "We

must establish such differentials as will permit the sale of a reasonable quantity of each class, maintaining such distribution that traffic requirements may be met. —We must set up a schedule under which there can be enough sold under each class to warrant a continuation of that classification.—A satisfactory distribution of the users of various classes of service is one of the most difficult problems in the establishment of telephone rates and it often has to be accomplished by a more or less arbitrary fixing of differentials.

As Mr. Wilder indicates, it is no easy task to establish differentials that will give a satisfactory distribution between various classes but a careful study of the effect of the differentials upon possible development of the various classes should give some basis for determining what differentials should be established. A study of the various orders of commissions in rate cases indicates, however, that such study has not been made either by the commissions or by the companies themselves.

As an illustration of a situation that is not uncommon, we find in a recent rate order applying to a city of approximately 2,500 inhabitants a schedule of residence rates as follows: Individual line, $2.50 per month; two-party, $2.25; four-party, $2.00. Without knowing anything of the local conditions, it may safely be predicted that the development of two-party service under this schedule will be very small. The people who cannot afford more than $2.00 per month will take the four-party service and a fairly good development of this class will result. Those who can afford more than $2.00 per month or who dislike party line service will jump the two-party class entirely and will pay the rate for individual lines. As a result, there will be only a few two-party users and they are likely to be so scattered that the majority of them will actually be getting individual line service at the two-party rate. If no greater differential is justified between four-party and individual line service, it would seem that the two-party line classification should be eliminated entirely.

In another case, an individual line business telephone rate was established at $4.20 while a two-party business rate was $4.00. If there is any reason at all for party line business service, it is to provide service for the small business house that has a limited use of the telephone and can not afford to pay the individual rate. It would seem that the difference of twenty cents per month would not make the two-party service attractive and that a very small development would result.

THE TREE TRIMMING SEASON

A number of telephone companies have discovered that the early months of the year are the most favorable for the annual job of tree trimming. This is a class of work that can be done during months when construction is nearly at a standstill on account of frozen ground and unfavorable weather. The tree trimming job can be done in weather that is unsuitable for wire work, or other work requiring the use of small tools.

From the standpoint of the trees themselves, it is better that the trimming be done before the sap starts; and, from the standpoint of securing trimming rights, it is found that property owners will grant permission for removing branches when the tree is bare of leaves that they will not permit to be touched when the tree is in foliage.

Deferring the trimming until summer or autumn, brings it into a time that can be used to better advantage for other work and also leaves the wires burdened with foliage and branches during the spring and early summer, with all of the resulting difficulties from low insulation. A few weeks of tree trimming in the months of January, February and early March is a wonderful spring tonic for any telephone system.

DO YOUR CONSTRUCTION SHOPPING EARLY

Thus we paraphrase the slogan of the Christmas shopping season. We are urged to do our holiday shopping early so that we may find a better selection of goods, smaller crowds in the stores and more time to search out suitable gifts for those whom we wish to remember. The reasons for early buying of materials for the telephone construction program are similar, but there are other weighty ones as well.

The telephone manager who makes up his requirements of construction materials early, has the opportunity to study the various products that are available and time to make a selection of the type that will best fit his needs. He may follow the markets and take advantage of purchasing when the prices are most favorable. This applies particularly to such materials as poles, copper wire and lead covered cable.

By making up his lists of supplies needed, he may do so leisurely and thus may avoid the difficulty of finding that certain items have been omitted and others bought in quantities either too large or too small.

The greatest advantage of all comes in preventing the annoying delays and losses of time that occur, due to the fact that certain necessary items are not on hand. Thousands of dollars are wasted each year, due to the fact that construction gangs get nicely started on jobs and then must be transferred to others, temporarily, or must be laid off until the management, by recourse to much telephoning and telegraphing, can pick up a rush shipment of essential supplies. There is every reason why construction buying should be done early—and the best time is NOW.

Telephone Facilities at New Union Station, Chicago

By R. J. FERRIS and F. T. FOSTER

The great Union Station project at Chicago which was started in 1914, and opened to the public in 1925, covers with its station and tracks an area of 35 acres, and serves the patrons of four railroads; namely, the Chicago, Milwaukee and St. Paul, the Pennsylvania, the Chicago and Alton, and the Chicago, Burlington and Quincy.

In the main building, comprising the station proper, shown at the left in the picture of the group of buildings, Fig. 1, are located part of the general offices of the railroads using the station as a terminal, those of the Union Station Company which operates it, the main waiting room, ticket offices and the service bureaus for handling the needs of the public in connection with train service.

Among the various factors contributing to the successful operation and management of the station, probably none is more important than the telephone service. Early consideration of the telephone equipment that would be necessary in the joint use of the station led to the organization of a committee to investigate the general problems, particularly those relating to the dispensing of information to the public regarding train service and those of caring for Pullman reservations. This committee, which was composed of representatives of each railroad company, visited some of the larger railroad terminals of the country and collected considerable data in connection with the provision of telephone service for railroads handled as a group. As a result of this study, it was decided to employ the system described below which consists fundamentally of equipment as follows:

1. A separate manual private branch exchange for each of the four railroads for handling administrative business.
2. A combined information bureau, under the supervision of the Union Station Company, to furnish the public information regarding train service.
3. A combined reservation bureau arranged so that each railroad company may handle and supervise its own requests for Pullman accommodations.
4. A semi-mechanical private branch exchange for the Union Station Company.
5. Attended public telephone pay stations to care for the needs of the patrons.

The four railroad private branch exchange switchboards are of the familiar manual types, which at the time of their installation appeared to best meet the needs of each particular company, and since they employ no unusual features, this article will be confined chiefly to a discussion of the equipment provided for the service bureaus and for the Union Station Company.

The information and reservation bureaus, together with the associated clerical forces, locker and supply rooms, occupy about 4,500 square feet of space on the third floor of the station building, and are entirely separated from the other telephone and office forces. Considerable care was taken to provide quiet operating rooms and good lighting facilities. The apparatus associated with this equipment is located in common with that of the Union Station Company's equipment on another portion of the same floor.

The accompanying photographs of portions of the actual equipment, together with the sketch showing in schematic form the method of interconnection, will possibly be of assistance in gaining an understanding of the manner in which the traffic is handled.

Information Bureau

The purpose of this bureau is to furnish information regarding train service to the public. Approximately 4,500 calls are received daily, and they may come directly from the central office or from the railroad and Union Station Companies' private branch exchange boards.

The equipment shown in Fig. 2 consists of three table-like sections of four positions each, two on each side, making a total of twelve positions. Two key-shelves per section are provided, one between each two operators' positions. The

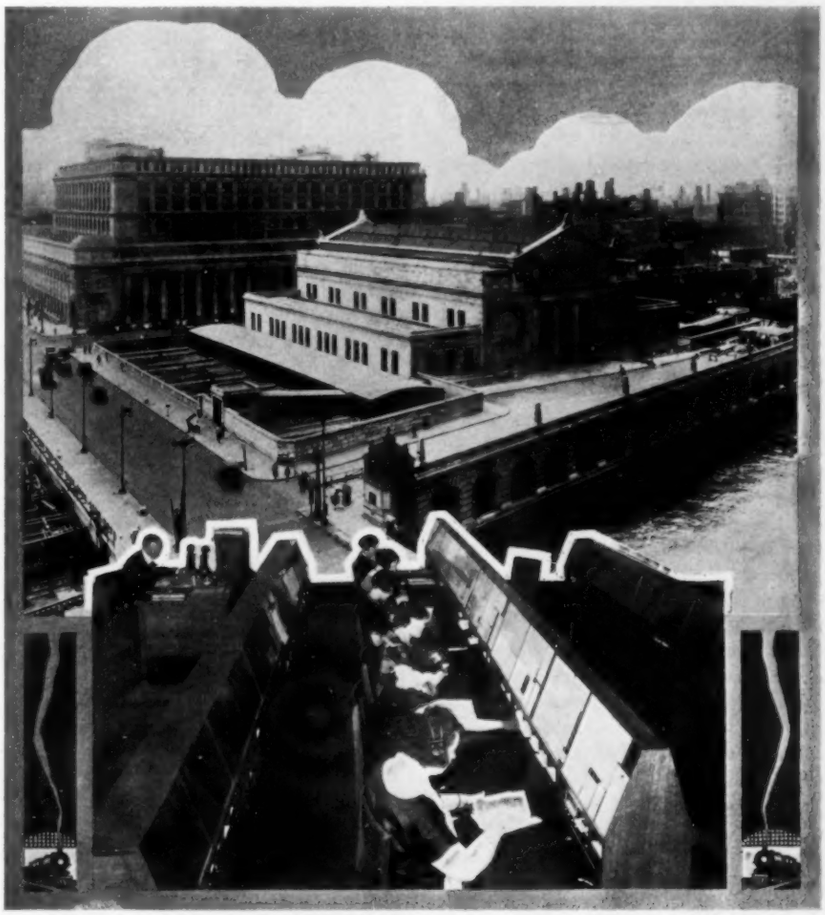


Fig. 1 (Above)—Union Station Buildings
Fig. 2 (Below)—Information Bureau

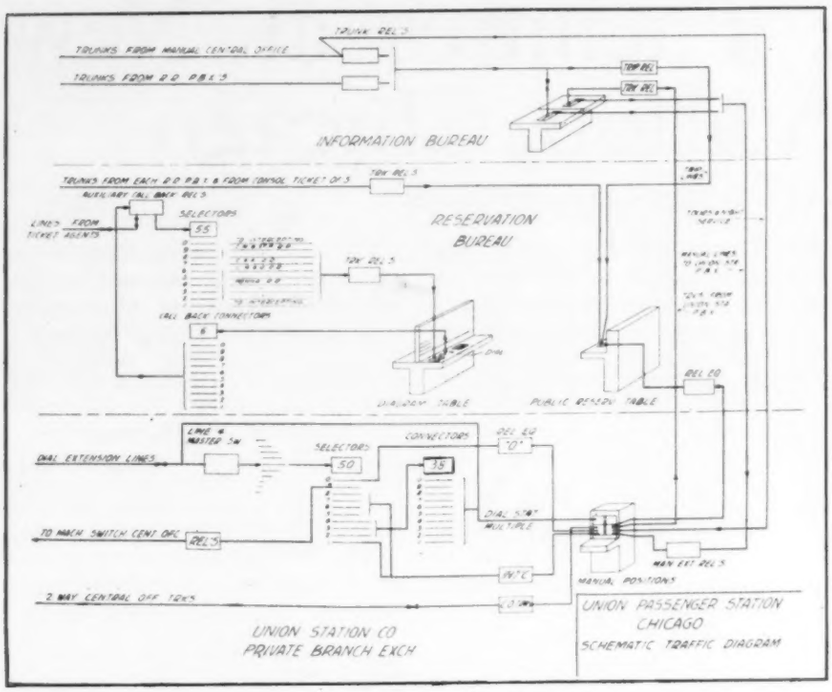


Fig. 3—Schematic Traffic Diagram

keyshelves, which are mounted flush with the top of the sections, are each equipped with 32 keys for terminating trunks and tie lines. Twenty of these keys are used for central office trunks and for tie lines from the four railroad boards as well as from the Union Station Company's semi-mechanical equipment. Two keys, one for each operator (designated "out") are arranged for outgoing service to the manual positions of the Union Station Company's semi-mechanical board, and two, one for each operator, to the information supervisor. There are also eight keys, a set of four for each operator, arranged to transfer calls to the reservation bureau, one key in each set being provided for each railroad company. The trunks from the central office, because of the large number, are divided into two groups, odd and even, each group appearing in alternate keyshelves throughout the lineup.

In order to obtain flexibility in the distribution of lines, cross-connections are provided on a rack located in the lower part of the sections. A glass-covered turret is mounted above the keyshelves in all positions, at a height sufficient to permit of operating the keys, and under the glass are displayed the train charts and other data for which information is frequently requested. Racks holding time tables, as shown in the picture, are conveniently placed on each side of and parallel to the table positions. The upper slanting portion of the racks is also covered with glass for the display of information similar to that displayed on the turret.

The supervisors' lines terminate on the bureau manager's desk, shown in the picture. This desk is also provided with lines for monitoring on the information operators.

The information bureau has a separate listing in the Chicago city telephone directory, and calls to it are, therefore, normally received over the central office trunks. In some cases, however, information calls may originate at the Union Station switchboard, or at any one of the railroad boards, and facilities have been provided for completing such calls to the information table over tie lines as noted above.

A patron, after receiving information as to trains and schedules, frequently desires to immediately make Pullman reservations. To care for these cases without requiring the patrons to make additional calls, a trip relay equipment has been provided for transferring the calls to the reservation bureau. This relay equipment is so arranged that when any one of the four transfer keys, mentioned above, is operated, the call is automatically transferred over one of the trip lines, shown in Fig. 3, and a lamp is lighted before the public reservation operator. By operating the proper transfer key, the call may be routed to the particular reservation positions where business for the railroad involved is handled. When the call has been completed, the operation of a release key at the reservation position will restore the circuits to normal.

An outgoing call may be made by operating the "out" key on a line to the Union Station Company's board and passing the number desired to the attendant, the same as is done on any manual extension.

Arrangements have been provided for handling requests for information made at night, or at other periods of light traffic, at the information bureau in the main waiting room. The central office trunks to the regular information table are multipled in the manual positions of the Union Station Company's private branch exchange. These trunks are equipped with locking keys which, when operated, transfer the incoming lamp signals from the information table to the Union Station Company's switchboard, where the calls are completed to the main waiting room bureau by the attendant.

Certain information regarding tours, vacation trips, etc., is handled by a separate bureau. When a request of this nature arrives at the regular information

Fig. 4—Reservation Bureau

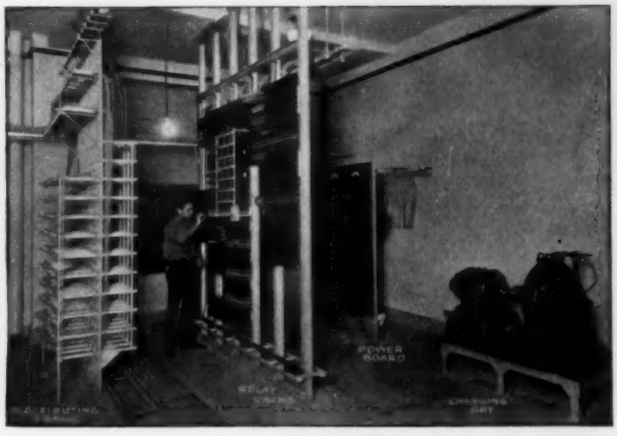


Fig. 6 and Fig. 7—Views of Switchroom

table, the trunk number on which the call is received, is passed over one of the outgoing lines to the Union Station Company's attendant, who, having access to a multiple of the information trunks, completes the connection to the proper person in the "tours bureau."

Reservation Bureau

This bureau which handles all business in connection with Pullman reservations is, insofar as telephone service is concerned, divided into two separate and disassociated parts. One, the public reservation table (shown at the right in Fig. 4) cares for all business originated by the public through the railroad and Union Station Companies' switchboards, through the consolidated ticket offices and from the information bureau. The other, known as the diagram table (at left in Fig. 4) cares for all business originated by agents at the station and consolidated ticket offices and at hotel agencies. While these boards are located in a common room and adjacent to each other, as shown in the picture, the telephone facilities for one have no connection with those for the other; however, the information required for conducting the business of both is the same. Considerable study was, therefore, given to the design and relative location of the two boards to make one common set of Pullman records readily accessible to both with a minimum expenditure of effort on the part of the operators.

The double-sided racks for holding the Pullman diagrams are mounted on the diagram board, making it necessary for the public reservtion operators to turn around and reach over the diagram operators to secure the information filed in the racks. As will be noticed in the picture, the keyshelves of the public reservation board and the associated chairs are considerably higher than those of the diagram table. This difference in design was governed by the obvious fact that less physical exertion is necessary in partially stepping down from a relatively high chair than would be required in arising from a low one. The distance between the two lines of boards was carefully worked out after the sections were delivered and the space reduced as much as possible, still allowing a satisfactory aisle for the supervisory forces.

Each railroad has a representative in the bureau to supervise the work concerning his company. Each representative is provided with direct lines to his private branch exchange board, and with monitoring lines to all bureau positions under his supervision.

Public Reservation Table

The equipment consists of seven two-position sections on which are handled approximately 1,500 calls daily. Terminating on this board in keys and lamps are trunks from each of the four railroad boards, from the Union Station semi-mechanical equipment and the transfer, or trip, lines from the information table.

The positions required by each railroad are grouped together and each group is located insofar as possible, directly opposite the diagram table positions assigned to the same railroad. Flexibility in distributing the lines in each group is provided by cross-connections on a rack located in the lower part of the sections.

Calls transferred from the information bureau have already been discussed under that heading. Those originating at any of the private branch exchange boards are handled in a similar manner except that the operation of the release key causes the private branch exchange supervisory lamp to light and the connection is then taken down by the private branch exchange operator.

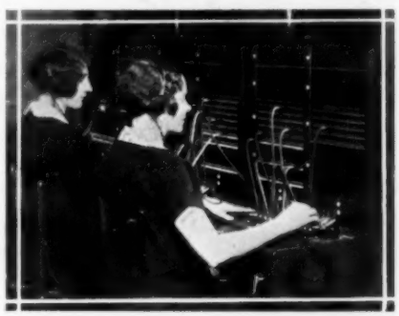


Fig. 5—Semi-mechanical Switchboard

Diagram Table

This, because of its unusual and unique features, is perhaps the most interesting part of the station telephone facilities. The equipment consists of seven four-position sections or a total of 28 positions. The sections are arranged with two positions on each side with space through the center for racks in which the Pullman diagrams are filed. The top of each position provides liberal writing space and is only thirty inches above the floor, permitting the use of ordinary desk chairs. To the left of the writing space are located the lamps and keys on which the trunks terminate. Dials are provided on some of the positions for operating the call-back feature which will be described later, and as in the case of the public reservation table, the positions required by each railroad are grouped together and flexibility in distributing the trunks in each group is provided by cross-connections in the lower part of the sections.

Approximately 4,000 calls per day are received on this board, all originated by the station, consolidated and hotel ticket agencies. Each of the 55 lines from the ticket agencies, terminates in an auxiliary call-back relay equipment and a step-by-step selector, on the levels of which appear the trunks to the diagram table. The lines are also bridged to the bank terminals of a group of 6 step-by-step call-back connectors. Each selector and connector has access to a bank of 100 terminals arranged in ten levels of ten terminals each.

Certain definite levels on the selectors are assigned to the trunks for each railroad as shown in Fig. 3, and levels 0 and 1, which are not assigned, are connected to the manual positions of the Union Station Company's private branch exchange where calls made in error to

these levels may be intercepted. All trunks for each railroad company appear in every position of the group used by that company, the order of answering being indicated by the use of different colored lamp caps. White indicates first choice, red, second choice, and green, third choice. Certain trunks may be arranged as first choice in one position, second in another position, and third in still another. Trunks from the selectors on which lines from hotel agencies are terminated, form a separate group, but the arrangement of levels is similar for both.

A part of the positions used by each railroad are provided with dials, as mentioned before, and also with outgoing lines to the ringback connectors for the purpose of making calls to the various ticket agencies.

The lines at the ticket agencies extending directly to the diagram table equipment are provided with ordinary dial instruments, and an agent wishing to call for a Pullman reservation lifts his receiver from the hook, and upon hearing dial tone, dials one digit, corresponding to the selector level on which the trunks to the particular railroad involved are located. This causes the selector brushes to travel upward to the desired level from which point they rotate automatically and select an idle trunk. The selection of a trunk lights an associated lamp on the diagram table where an operator answers by depressing a locking plunger type key. When the conversation has been completed, the operator disconnects by depressing the associated release key and the apparatus is restored to normal as soon as the calling agent replaces his receiver on the switch hook.

If a request for Pullman accommodations cannot at once be filled, it may be found possible to care for it later, because of cancellations or other reasons, in which case it becomes necessary to call the agency from which the request originated. This work is handled only from designated positions, those equipped with dials, in each railroad group. To originate such a call the operator depresses a key on one of the outgoing lines, which connects her position equipment to a "call-back" connector. The operator then dials two digits, the first of which elevates the connector brushes to the proper level, and the second rotates them to the particular terminal in that level on which the desired line appears. When connection to the line has thus been established, the incoming selector is disconnected from the line by means of the auxiliary relay equipment and the distant telephone bell is rung automatically. At the conclusion of the conversation the operator restores the key and when the called party hangs up his receiver, the equipment is again restored to normal.

Union Station Company's Semi-Mechanical P. B. X.

Early studies of the telephone needs of the administrative forces in conducting the many activities incident to the operation of the station, indicated the necessity of handling a large amount of interdepartmental traffic. Because of this, it appeared desirable to employ equipment of the semi-mechanical type.

The equipment, which was engineered to handle approximately 13,000 calls daily, consists primarily of the following:

Two positions of multiple type switchboard.

Three hundred line switches.

Fifty selectors.

Forty connectors.

One power plant.

The two positions of switchboards as shown in the picture, Fig. 5, are located in a separate operating room adjacent to the switch room in which the mechanical apparatus is mounted. In the panels of this board are terminated the various tie lines and the two-way trunks to the central office, as well as a multiple of all extension telephones lines connected to the mechanical equipment. The key-shelves are equipped with dials and double-ended cord circuits.

The plunger type line switches are arranged in units of 100 and each unit is enclosed in a glass case in which are also mounted the connectors. The connector side of these cases, or boards, as they are usually called, is shown at the rear in one of the accompanying pictures of the switch room, Fig. 6.

The selectors are mounted on the selector frame, shown at the front in the picture. On this frame are also mounted the selectors and call-back connectors, associated with the diagram table.

Flexibility in the distribution of lines and trunks is provided by cross-connections on the distributing frame shown, and the relay equipments required in the various circuits, including those of the information and reservation bureaus, are mounted on relay racks which are also shown in another one of the pictures, Fig. 7.

The power plant consists of a 48-volt storage battery for supplying talking and signaling current, a motor-generator set for charging the battery, ringing machines for supplying ringing current and the various tones, and a power board on which is mounted the control apparatus. The motor-generator set is mounted on a steel machine table shown in Fig. 7, while the ringing machines, both regular and emergency, are mounted on the lower part of the power board. Battery voltage regulation is maintained by six counter E. M. F. cells which are automatically cut in and out of the circuit as the voltage varies. The charging set is also automatically controlled during normal operation. Over-charging the batteries, however, must be controlled manually.

The dial extension lines connected to this equipment, terminate on line switches, the banks of which are connected by trunks to the selectors. The selector banks are in like manner connected to the connectors, on the banks of which appear a multiple of the extension lines. The selectors and connectors are similar in design and function to those used in connection with the diagram table. The assignment of the selector levels is shown on the sketch, Fig. 3.

To make an intercommunicating call —that is, a call from one dial extension to another—the calling party takes his receiver from the hook, and upon hearing the dial tone, dials three digits. The act of taking the receiver from the hook causes the associated line switch to connect with a trunk to an idle selector. The first digit dialed elevates the selector brushes to the level (corresponding to the

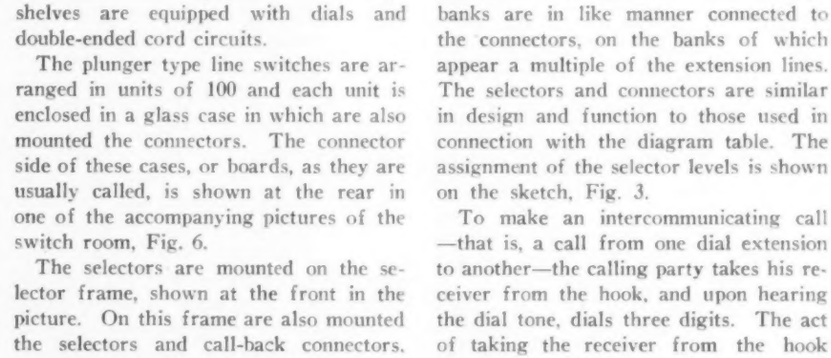


Fig. 8—Attended Pay Station

digit dialed) on which trunks to the proper connector group are terminated, and the brushes then rotate automatically to select a trunk to an idle connector. The second digit dialed, in turn elevates the connector brushes to a corresponding level, and the third digit rotates them to the particular terminal on which the called line appears. When the connection has been established, the called party's telephone bell is rung automatically. At the conclusion of the conversation both parties hang up the receivers, and the apparatus automatically restores to normal, the line switch and selector under control of the calling party's switch hook and the connector under the control of the called party's switch hook. In case the called party's line is busy, the connector will return a "busy" tone to the calling party.

To make a call from an extension to a central office line, the calling party proceeds the same as on an intercommunicating call, except that only one digit is dialed. This causes the selector brushes to select an idle trunk to the central office and then as soon as the central office dial tone is heard, the calling party dials the desired number as listed in the telephone directory.

Certain central office calls, such as those for toll, or calls to the service bureaus, are handled by attendants at the manual positions, who may be reached by dialing "0." Calls made in error to vacant selector levels or to vacant connector terminals which have not been assigned, are also completed to these attendants, where they are intercepted.

All incoming calls from the central office are received over the two-way trunks at the manual positions where connections are established by the attendants to the extension multiple which appears in the face of the board. At this switchboard are also handled certain calls from the information bureau, as previously described, as well as calls to the reservation bureau.

Public Pay Stations

The telephone needs of the traveling public are cared for by two attended public pay stations of the usual manual type, one of which is shown in the accompanying photograph, Fig. 8. One, located in the concourse, consists of an attendant's position and 17 booths, the other, in the main waiting room, consists of an attendant's position and 15 booths. In addition there are 10 non-attended public telephones located in the concourse and 6 each in the women's and men's waiting rooms.

South Dakota Convention Again Elects Straight Year's Leader

Sioux Falls, S. D.—W. W. Straight of Crooks again was elected president of the South Dakota Telephone Association at the 20th annual meeting of the organization held here. Thomas Phalen of Aberdeen was re-elected secretary-treasurer. F. F. Orcutt, Onida, was named vice-president and was placed on the executive committee, most of the members of this committee being returned to office.

Advising consolidation of neighboring smaller companies as the chief remedy for their mistakes of the past, J. C. Crowley, secretary-treasurer of the Minnesota association, cut loose with a stirring and thoughtful address before the two hundred South Dakota men who attended the sessions. Crowley sketched the development of the telephone industry's manufacturing, operating and public relations, and summarized the significant periods and their effects. He declared himself strongly in favor of commissions organized by appointment rather than election. As a result in many cases of economies being carried to extremes, so Crowley said, many of the smaller companies are finding themselves "up against it." In suggesting a way out he advised:

"In many instances the exchange property in itself is too small to exist on the revenues it might obtain from its local service.

"If it should happen to be one of those exchanges that has a large list of switched service stations, as compared with the number of local stations served, then the answer is a consolidation of all interests into one company, so that the field of spread will be sufficiently wide that each class of service will share its just proportion of the costs of rendering the service.

"In this way, the unified service can employ a competent maintenance man, assuring service to all in prompt repairs done in a satisfactory manner and in accordance to standard practice.

"In many sections, there are small exchanges of from 75 to 150 subscribers or more, where three, four, five or six towns or villages can be grouped into one or two central offices by a complete cable system tying these units together, placing them under competent supervision and management.

"In these days of good roads and the automobile, these groups could be operated and maintained profitably at a nominal increase over the present rates, assuring to all a continuous service throughout the year; while under the present method, these same exchanges, as separate units, are unprofitable; service is given for a limited number of hours per day, and they depend largely upon God, wind and the weather for maintenance.

"The type of rural lines owned and operated by farmers is one that is probably more troublesome to the manager of the telephone exchange than all other types of service combined, for in most instances no inspection or repairs are made on these lines until the line itself is out of commission; and when repairs are made, they are of a temporary character, made by some novice rather than a competent repairman. The public, not being aware of the division of ownership, complains to the local manager, who, under present methods, is helpless to remedy the difficulty.

"My prediction as to what will become of this class of farm line, unless the owners agree with the proposition heretofore made as to consolidation of interests with their respective exchange, is that they will eventually go begging for ownership."

Crowley also cited the return of college-trained farm boys and girls to the ancestral roof as a strong factor in promoting a demand for rural service approaching the metropolitan standard. He counseled more interest and battle from the owners of smaller telephone companies whose business affairs outside of the telephone industry possibly cause them to look upon their telephone company as a step-child.

H. P. Hartwell of Irene, an active figure in the state's telephone industry, and former state legislator, spoke on "How Vicious Legislation Can Be Prevented." "Plant Maintenance-Depreciation Accounting Methods" was the subject of an interesting address made by G. A. Anderson, general manager at Aberdeen. Another intimate and helpful talk on adequate rates was given to the convention by R. F. Wilder, the Tri-State's commercial superintendent. Charles Deering, secretary-treasurer of the national association, and Harold Brown, president of the North Dakota association, also were featured speakers. The state government was well represented by J. J. Murphy, a member of the railroad commission, who spoke on co-operation, and by B. W. Baer, director of taxation. Mr. Baer pointed out that the state's telephone property for taxation purposes had increased from $3,641,862 in 1913 to $6,314,617 in 1925. This 73 per cent increase for the industry was explained, and as some ways of relief the speaker suggested checking up on undervalued property, reform in public spending, and withdrawal of the state from enterprises outside the function of government.

California Meeting Endorses Joint Pole Agreement Terms

Pomona, Cal.—The joint pole agreement, which has engaged the attention of experts from the telephone and electric companies and from the utility commission for some months, commanded the spotlight for the greater part of the California Independent Telephone Association's well attended meeting held here.

The lively session handled the ordinary problems of operation with some practical open forum expressions, and accepted the joint pole agreement presented to it, recommending the pact to the association members for individual sanction and use. Walter J. Dodge, telephone engineer of the state commission's staff, was chairman of the committee responsible for the agreement. Other members were J. E. McCaffrey of the commission, Fred G. Hamilton of the Southern California Edison Co., A. Wardman, secretary of the Whittier and Downey Home Telephone Co., and Ernest Irwin, secretary of the state telephone association.

The basis of the agreement provides that the telephone utility may obtain necessary space for its signal circuits on a rental basis on poles owned by the electric company. The following outlines briefly the main features of the proposed agreement:

(1) Rental and Joint Ownership Agreements: It has appeared advisable, due to agreements, unless so desired by the respective companies involved.

(2) Charges: Primarily for the simplicity in billing and bookkeeping and the practicability of application, a flat rental charge of $1 per cross arm, or crossarm attachment, per year is contemplated rather than a sliding scale of charges.

When a telephone company desires the electric company to install higher poles, the agreement provides that this may be done on a reasonable cost basis to the telephone company and with the privilege of using such pole for a period of not less than ten years.

Where the electric company has overbuilt the lines of the telephone company, the agreement proposes that only a charge of $5 be made for each additional 5 feet of pole where the telephone company desires the electric company to install higher poles than necessary for existing telephone facilities. As before, a ten-year period is proposed for the use of such poles.

The agreement proposes, in connection with the trimming of trees, that the electric company bear one-third of such tree-trimming cost regardless of the proximity of the trees to the electric company's lines, and the telephone company is to bear no part of the cost where cable construction in distinction to open-wire construction is used. Where the tree-trimming costs become burdensome, the telephone company has the option of obtaining higher clearances by purchasing higher poles from the electric company, in which each pays one-half of the replacement cost with the privilege of use of such poles for a period of ten years.

Where the electric company contemplates abandoning a line, it is proposed that the telephone company be permitted to buy such poles at the pole-yard salvage value, and where the electric company desires to replace a telephone pole, it is proposed that the electric company bear the entire installation cost of that new pole and also credit the telephone company with an amount of $5 or $10, depending upon the size of the pole, for each pole so replaced.

(3) Construction Features: The agreement provides that the telephone company is to be permitted to install five cross-arms or occupy ten feet of pole, and the electric company is to limit the span length to 300 feet where bare open wire is used and 175 feet where weatherproof wire is used. This will allow the telephone company to contract all electric poles, spaced 175 feet or less, with either open wire or cable and install poles without unnecessary short spans where the electric company's poles are spaced at 300-foot intervals.

It is proposed that neither the electric company nor the telephone company underbuild or overbuild the other's lines and that where the electric company is occupying both sides of the street and the telephone company requests the use of one side of the street, providing the potential of the electric company's lines does not exceed 17,000 volts, the electric company will, without charge to the telephone company, furnish poles of sufficient height to give the telephone company 10 feet of clear space over trees or normal clearance where there are no trees.

It is also provided that, where the electric company has created an existing overbuild, the electric company will provide poles of sufficient height to give a 2-foot clearance over trees and in addition to a 2-foot clearance over that necessary for normal clearance.

The agreement provides that the electric company may increase the voltage of its lines up to and including 5,000 volts without the consent of the telephone company; and that the electric company may increase the voltage of its lines above 5,000 volts up to and including 17,000 volts without the consent of the telephone company, but that if the telephone company elects to vacate the poles of such lines the electric company will refund to the telephone company the original amount paid toward any replacement of the electric company's poles.

It is also contemplated that the electric company may not increase the voltage of its lines in excess of 17,000 volts nor locate on lines used by the telephone company without the consent of the telephone company. When the telephone company so consents and elects to vacate such poles, the electric company then will refund to the telephone company the original amount paid toward any replacement of the electric company's poles. In all such cases, the agreement provides that the electric company shall notify the telephone company when it plans to increase the voltage of its lines.

(4) Length of Agreement and Board of Arbitration: The contract provides that the agreement shall continue in effect for a period of 25 years. This agreement contemplates harmonious business relations as well as maximum economy and the best service to the public. In order that these features may be promulgated and continued, a clause has been included which provides for a board of arbitration to pass upon questions of interpretation or other matters which may be questioned or disputed.

(5) General: The occupany of joint poles will increase the safety both to the utilities involved and to the public. Collinear construction will be eliminated in the future, which will result in improved service as well as safety. Fewer complaints from the public should result. Better results will be obtained not only from the standpoint of economy but also from the standpoint of unsightliness and hazard.

"In submitting this agreement," the committee report stated, "we do not mean that this is the final word and that all difficulties or conditions will be met, but it is felt that application of the principles as set forth in this agreement will be in the interest of the telephone utilities, the power utilities and the public. It should be borne in mind that as conditions change and new problems arise, this agreement will necessarily have to be changed or modified from time to time."

A. Wardman, of Whittier, stated that the extended use of joint facilities will enable the telephone company to eliminate the small sawed pole, a typical Western product, and thus will tend to improved, heavier construction, to the end that there will be a saving in investment for the same class of construction, and a betterment of public relations through the elimination of pole lines, less tree trimming, etc.

Sender in Paneltype Machine Switching System

By F. J. DOMMERQUE,
Fellow, A. I. E. E.

The principal function of the sender is to translate the impulses received from the calling subscriber's station on a decimal basis into the non-decimal basis of the arrangement of the 500-line switches. The various pieces of apparatus constituting the sender are partly of a design peculiar to the panel type system, partly of such well-known design as relays and rotary switches; they will be described as the discussion goes on.

When the calling subscriber lifts his receiver from the switch-hook his line is automatically connected to an idle line finder which is illustrated in Fig. 1. It has the general appearance and construction of a 500-line panel switch, but its banks are smaller in size as they are not hundred-line banks, but contain only a small number, 25 or 30, for the reason that the lift rod should not have to travel over such a long way vertically. They are of the back-selecting type. Individual line switches may be used instead of the panel type line finders and at some future occasion when the circuits are to be described, they will be so indicated as it facilitates understanding. A sender selector attached to the line finder connected to the calling subscriber selects an idle sender. This sender selector is a switch of the rotary type illustrated in Fig. 2. As soon as an idle sender is found, the calling subscriber hears a humming sound in his receiver, which indicates to him that everything is prepared to dial the desired number. The impulses from the dial are received and registered by the registers. These are rotary switches with ten contact sets and brushes propelled by an electromagnet similar to the sender selector switch. There is one register for every letter and digit in the desired number. The "Registers" are part of the sender, also the "Counting Relays," a normal type of relays of which there are twenty in each sender. They serve the purpose of counting the impulses sent by the switches, as will be explained presently.

It was stated above that the line finders are of the back selecting type. This means that the calling subscriber's line terminates in the fixed contacts and that the brushes wipe over the contacts until they find the calling line. The calling subscriber when lifting his receiver closes a circuit at the exchange through a line relay. The line relay, a stepping relay

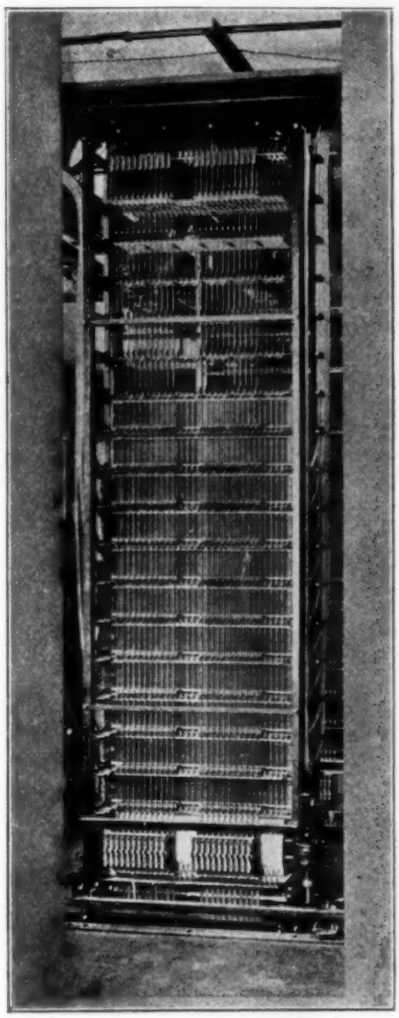


Fig. 1—Line Finder Frame Showing Banks and Selecting Mechanisms

and the counting relays form a circuit which is called the "Fundamental Circuit." This fundamental circuit serves to make the selections as well as the final connections. An accessory to the circuit is a "Commutator," over which are transmitted the impulses sent by the sender. In the Fig. 5 of the article on "Power Driven Automatics" (December, 1925), a commutator was shown at the lefthand side about midways with a brush resting on it. In reality the commutators are located above the terminal panels as shown in Fig. 3 of the December, 1925, number, and the commutator brushes are attached to the top end of the brush shaft. A commutator as actually in use is shown separately in Fig. 3 of the present article. The left hand picture shows the brush feed and the right hand picture the commutator side. In order to avoid moving cords up and down, they are permanently attached on the feed side of the commutator. The commutator itself consists of plates, some of which are conducting segments and others are non-conducting.

Before going any further it may be stated what the non-decimal basis for the operation of the switches is to be. This depends on the grouping of the trunks and lines in the switches. Since the full mechanical unit is limited to four digit figures or 10,000 terminals, and each final frame has a capacity of 500 lines, there are required 20 final frames for one full unit. As a group of trunks from the incoming frames must lead to each final frame, the incoming frame must be arranged for 20 groups, each of which to consist of 25 terminals to make the 500-frame capacity.

To explain the connection between the decimal basis and the non-decimal operation an example will be of assistance. Assuming, therefore, the number 7654 is to be connected.

Selection

The impulses coming from the dial step the registers by means of step magnets which cause the brush sets of the registers to take a position corresponding to the number of impulses. The registers, being rotary switches with ten contact sets align themselves as follows: The thousands register with its brush on the seventh contact, the hundreds register with its brush on the six contact, the tens register with its brush on the fifth contact and the units register with its brush on the fourth contact.

The trunks in an incoming frame are divided into five sections of 2,000 lines each, each section being reached by one of the five brushes on the brush shaft. The trunks to the line 7654 are located in the fourth section 6000 to 7999, consequently the fourth brush must be selected to be tripped into connection with the proper trunk. Each 2000-line section, or rather the 100 trunks in a 2,000-line section are divided into four groups of 25 trunks, each leading to 500 lines; consequently the trunk leading to the line 7654 is in the fourth group 7500 to 7999.

Therefore the fourth group must be selected.

The final frame containing the lines

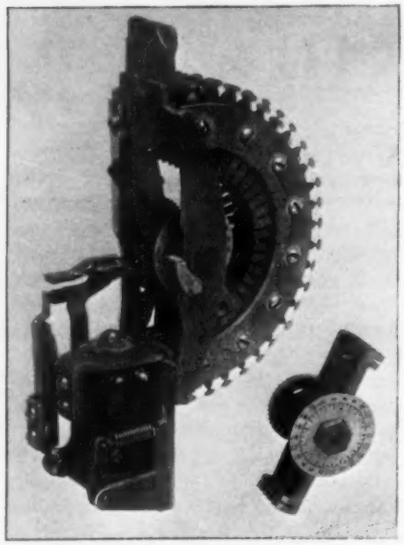


Fig. 2—Sender Selector

7500 to 7999 is divided into five sections of 100 lines each with a brush for each section. As 7654 is located in the second section of 100 (7600 to 7699), the second brush must be selected for tripping. As the lines in each section are again divided into ten groups of ten lines each, the line 7654 is located in the sixth group, 7650 to 7659, whence the sixth group is to be selected in the final frame.

Each group of ten lines is again divided into units, and as the unit digit in 7654 is 4, the final brush will be advanced to the fourth terminal in the group. Thus for each frame except the final, two selections must be made, a brush selection and a group selection. On the final frame a brush, group (or tens) and a unit selection must be made. On the other frames after group selection a trunk in the group must be selected, but this is not governed by the desired number.

Fundamental Circuit

The fundamental circuit contains in addition to the line relay the final relay in case of the brush and group selection and the connection in the final frame, an incoming line relay in the case of brush and group selection in the incoming frame—the stepping relay, the commutator, the counting relays and the registers, also the translators, where translation is required. The final frame has its lines arranged in panels of 100 lines each; this is, therefore, on the decimal basis and does not require a translation for connection to the line terminals, hence it presents the most simple case for the description of the fundamental circuit and will be chosen for illustration.

As a register contact forms a part of the fundamental circuit the contact 4 in the unit register of the example will be utilized. On closing the fundamental circuit, Fig. 4, the stepping relay STR operates and establishes a circuit from battery through counting relay 4, over armature of counting relay 4′, contact 4 and switch lever or brush of unit register to ground on armature of relay STR. Counting relay 4 operates and prepares a circuit for counting relay 4′ through its winding, over armature of counting relay 4 to ground. The ground on armature of relay STR, however, shunts the counting relay 4′ and prevents it from operating.

At the time when the stepping relay is operated, the line relay LR is energized and closes a circuit through updrive magnet UP, which causes the brush shaft to be lifted upward and with it the commutator brushes. When the commutator brush, which is now being elevated reaches the first conducting segment of the B commutator (there are various commutators A, B, C, etc., according to the purpose for which they are used), a shunt is placed around the stepping relay STR and the latter relay is de-energized. Counting relay 4′ now operates and prepares a circuit for counting relay 3. When the commutator brush leaves the first conducting B segment, the shunt around stepping relay STR is opened and the relay STR operates again and also counting relay 3, which prepares a circuit for counting relay 3′ through its winding, over armature of counting relay 3 to ground. The process of shunting the stepping relay, and of the commutator brush opening the shunt as it advances over further conducting B segments is repeated. The fifth shunting of relay STR will permit the operation of counting relay 0′, whereby the fundamental circuit is opened and line relay LR de-energized. The circuit of the up-drive magnet UP is opened, while the brush set rests upon the terminals of the desired line. For the connection of line 7654 the following counting relays have to be in the fundamental circuit:

Incoming frame: Counting relay 3 to select the fourth brush; counting relay 3 to select the fourth trunk group.

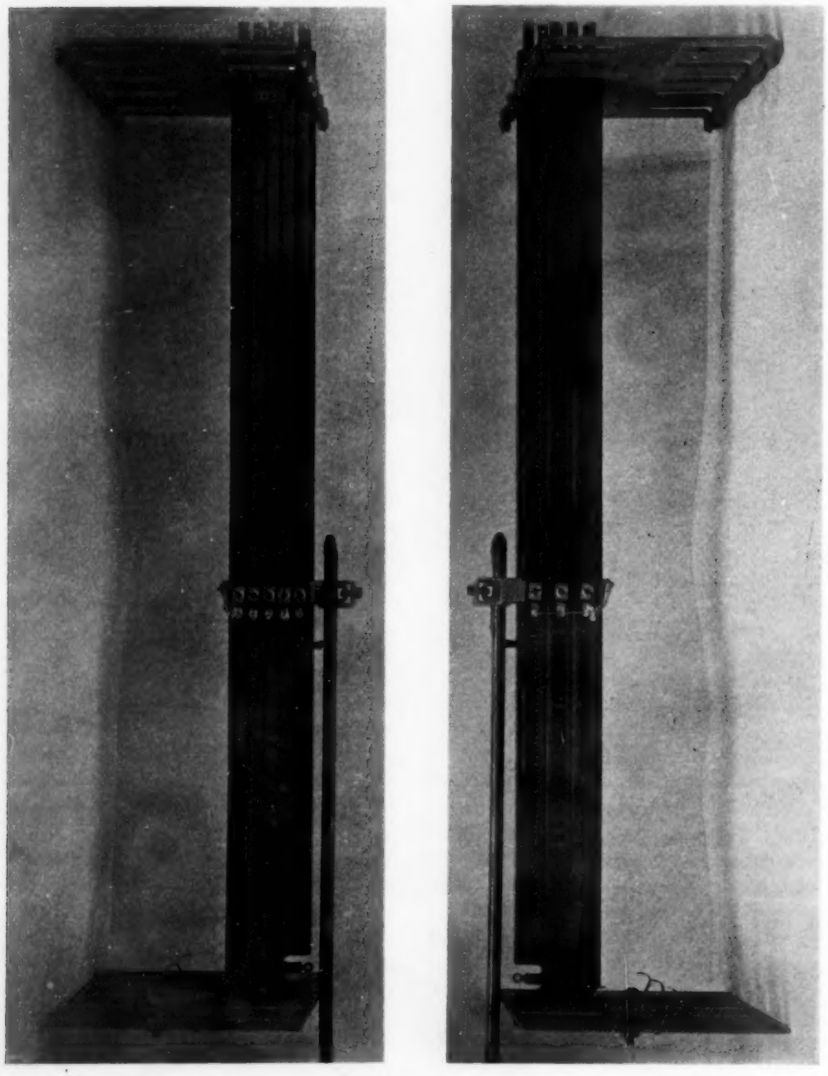


Fig. 3—Commutator

Final frame: Counting relay 1 to select the second brush; counting relay 3 to connect to the fourth line terminals.

Translation

The brush and group selections require translation. To this end the contact area of the thousands and hundreds registers have their contacts cross-connected in correspondence with the subscriber's and trunk groups in the frames so that each time the fundamental circuit is used, either for brush or for group selection the number registered on the decimal basis is properly translated for counting by the counting relays. This cross-connection for a 10,000-line exchange is shown in Fig. 5.

The switching over of the fundamental circuit from brush selection to group selection and vice versa is effected by sequence switches, which will be described at some future occasion, when also the method of switching will be narrated.

In a large exchange, instead of using five or more digit numbers, letters are added to the four digits. In a sender for an exchange with letters, additional registers are required. Take for instance a two-letter office, such as illustrated in Fig. 5. It contains the unit, tens, hundreds and thousands register, an A and a B register. The A and B registers are set by the calling subscriber dialing the two letters. As will be seen from the figure the A register contacts are connected to the B register brush or wiper. As each contact in the A register can combine with each contact in the B register, a total of one hundred combinations can be made, which means that hundred offices could be accommodated in a two-letter system. But the construction of the translator switch provides only 40 contacts and thus the number of offices is limited to forty, which is not exceeded except in very large cities. In

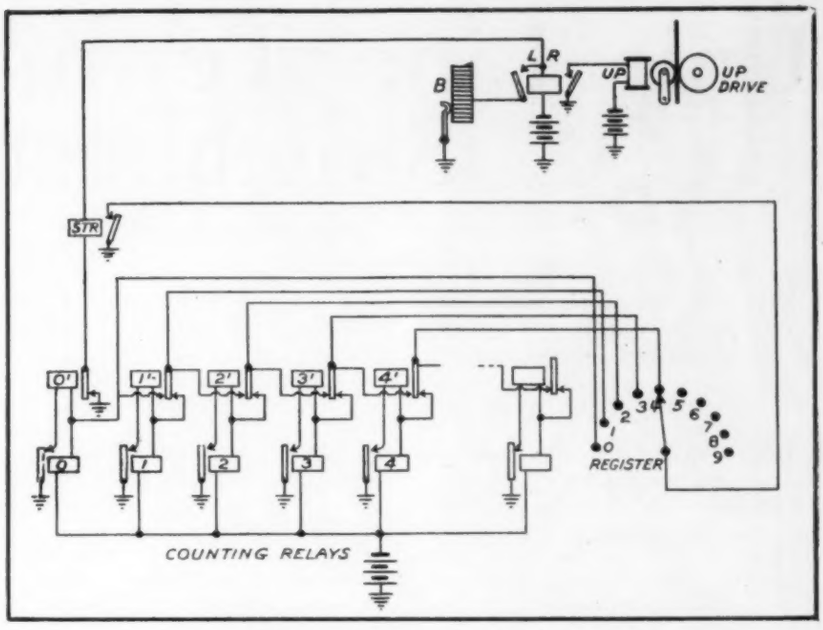


Fig. 4—Fundamental Circuit

that case three letters are used, which would introduce a C register, permitting of one thousand combinations and thousand offices. Here four hundred offices would be the practical limit.

A translator switch is also a rotary switch but contains two contact banks arranged side by side. The brush shaft carries two sets of brushes, 180 degrees apart; that is, the brush arms for one bank form an extension of the brush arms for the other, so that when one brush set has completed its travel over its associated contacts, the other brush set will begin to travel over its associated bank. In this manner contacts 10, 11, 12, etc., follow after the ninth contact. The translator is a power-driven switch. It is set in motion and continues until its test brush reaches a position governed by the joint setting of the A and B registers when it stops. The arcs of the translator are cross-connected to the counting relays according to a predetermined code so that, when the translator set has one of its brush sets in engagement with the contact controlled by the joint setting of the A and B registers, a certain brush set and a certain group will be selected at the district switch, and a certain brush set and a certain group by the office selector switch with the same setting of the translator brush set. The setting of the translator switch determines also the position of the class switch, whereby the class and routing of the call is determined; that is, whether office impulses, relay call indicator impulses (to manual offices), or any other kind are to be sent.

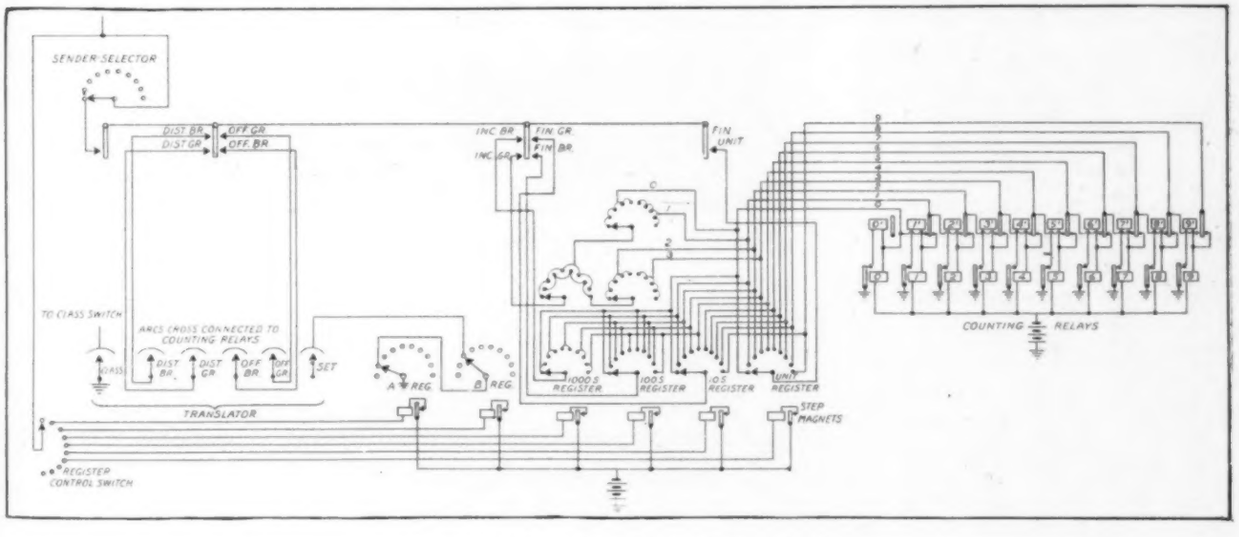


Fig. 5—Skeleton Diagram of Sender Circuit

Unit Line Terminus Is at Switchboard

By JOHN M. HEATH,

32. *Relay Racks.*

Relay racks are simply vertical iron bars, bored with holes and properly spaced for receiving the relay mounting strips.

33. *Relay Mountings for Line and Cut-off Relays.*

Relay mountings are strips bored for mounting ten line and ten cut-off relays on the same strip. Notice in Fig. 27 the first relay on the right is a line relay and the next one to it is a cut-off relay. These relays run in pairs throughout, and each pair (one line and one cut-off) serves one subscriber line.

At the upper edge of Fig. 28 can be seen two common wires running throughout the length of the strip. The insulated wire is for battery and leads to the fuse panel, the bare wire leads to ground and is grounded at the edge of the relay rack. Referring to Fig. 20 (Jan., 1926, p. 27) the two windings from the line relay lead directly to the two long springs of the cut-off relay. These mutual connections between each pair can be clearly seen in Fig. 28.

These strips of relays are provided with a tin cover that slides over them from the rear and neatly incloses the whole strip, thus protecting the contacts from dust and mechanical injury.

The unit line, Figure 20, occupies one pair of these relays, i. e., one line and one cut-off relay.

34. *The Line Relay.*

This relay is designed to operate on a subscriber's loop of not more than 1,000 ohms resistance, including the subscriber's station.

Each coil of this relay is wound to a resistance of 1,000 ohms and is designed to operate on a battery potential varying from 20 to 28 volts, depending upon whether the office storage batteries are "up" or "down."

The winding of the relay consists of 12,000 turns. It develops an operating strength varying from 77.4 to 76.8 ampere turns, depending upon the variable conditions as to battery and resistance of the subscriber's loop.

The function of the line relay is to close one set of contacts (Fig. 20), when the subscriber lifts his receiver from the hook. These contact springs can be seen in Fig. 29. The two springs on the right rear are the terminals to winding No. 1 (Fig. 20). Of the three terminals in the right foreground, the upper one is the open contact, the middle one is the common that leads to the fuse and long spring and the lower one is the left hand terminal of winding No. 2, all as shown in Fig. 20.

35. *The Cut-off Relay.*

In case of a subscriber calling, the function of the cut-off relay is to open two contacts and de-energize the line relay. This is brought about by the operator inserting a plug in the answering jack with battery on the sleeve of the cord. In case of a subscriber being called, the function of the cut-off relay is to prevent the line relay from becoming energized, by opening two contacts leading to its winding. This is brought about by the calling operator inserting plug in the multiple jack with battery on the sleeve of the cord. The springs that perform these functions can be clearly seen in Fig. 30.

This relay is wound to 30 ohms resistance and is not surrounded by the variable operating characteristics that surround the line relay inasmuch as it is at a standardized distance from the battery supply.

36. *Line Lamps and Answering Jacks.*

Fig. 31 shows one strip of ten line lamps (bottom) and one strip of ten answering jacks (top). The answering jack associated with any particular line

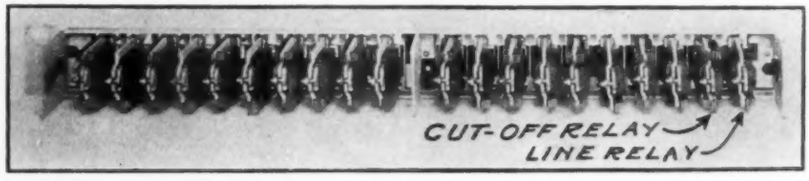


Fig. 27—Elevation View of Strip of Line and Cut-off Relays

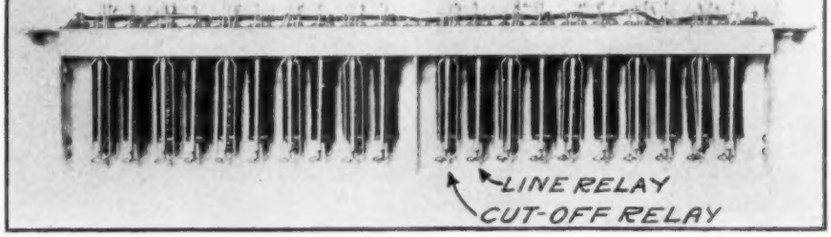


Fig. 28—Plan View of Strip of Line and Cut-off Relays

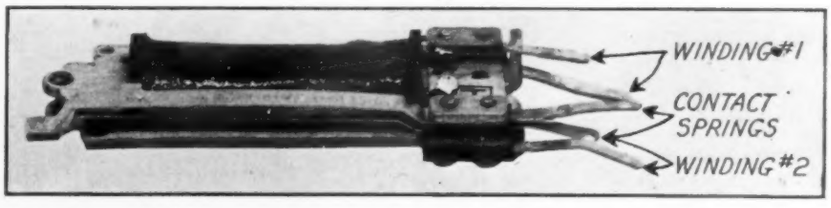


Fig. 29—Flat Type, Double Wound, Line Relay with Single Set of Make and Break Contacts

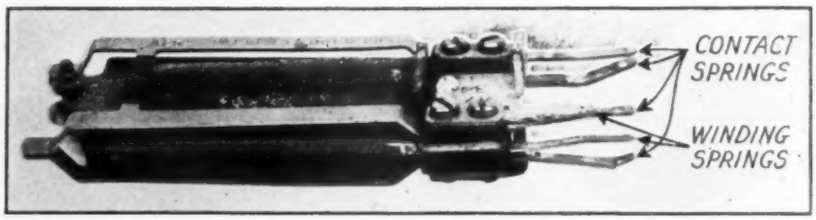


Fig. 30—Flat Type, Single Wound, Cut-off Relay, with Double Set of Make and Break Contacts

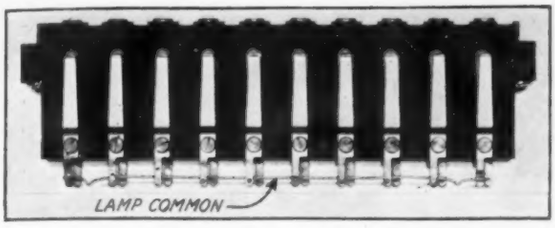


Fig. 32—Broadside of Strip of Lamp Jacks

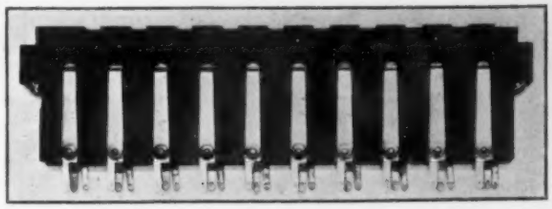


Fig. 33—Broadside of Strip of Answering Jacks

lamp is the jack immediately above the lamp. The small hole to the left of the answering jack is for a number plate pin.

Fig. 32 is a broadside view of the same strip of line lamp jacks. Notice the two contacts to each lamp jack, and the front one of the entire strip wired together, this is known as the "common," i. e., common contact and is the grounded side of the lamps (see Fig. 20).

These jacks run anywhere from 60 to 120 per panel, depending upon the nature of the traffic and construction of the switchboard.

The jacks in each panel are numbered in a separate series, beginning with 0. This is for the purpose of quickly locating the aswering jack of any telephone.

The testman may come in on 2859 and ask the operator what panel and jack number he is on; she may say for instance, panel 10, jack 89. This fixes its location on the switchboard and also identifies the line and cut-off relay and four-point terminals associated with it.

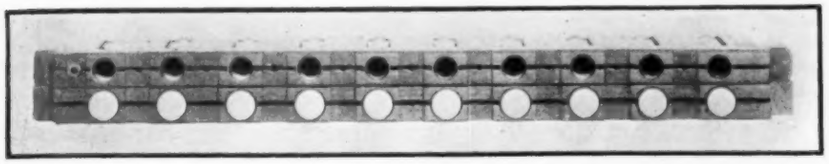


Fig. 31—Strip of Each, Answering Jacks, and Associated Line Lamps

Fig. 33 is a broadside of the same strip of answering jacks, each jack having three contacts (see Fig. 20). The contact that is nearest the observer is the ring contact.

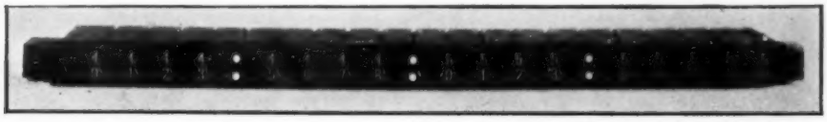


Fig. 34—Strip of Ordinary Multiple. The Middle Strip Is a Bank of 100. (See Fig. 35)

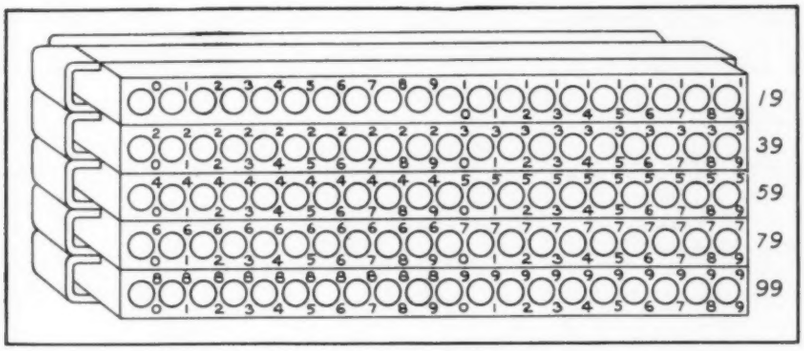


Fig. 35—Multiple Jack Bank; 100 Jacks Per Bank

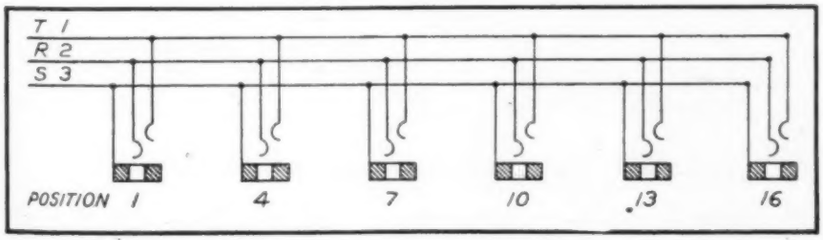


Fig. 36—Illustrating the Recurrence of Multiple Jacks Throughout the Length of the Switchboard

(Refer to paragraph 31.)

The chief operator keeps a panel and jack record of all lines coming in on the switchboard. Likewise it is marked on the subscriber's station card.

The unit line, Fig. 20, occupies one line lamp and one line jack in the strip of jacks shown in Fig. 31.

This is the only place on the entire switchboard where this line is habitually answered.

37. *Determining the Telephone Number.*

Assume that the commercial department has written an order for a new telephone, the first question that arises is what telephone number to assign. Such things as the class of service and party lines in the vicinity of this new subscriber would, of course, have some bearing on the case, but assume that it is a one-party line. In this case the thing that would definitely determine the number would be the multiple. The multiple is fixed in the board, is given a number when it is installed and is never changed. So inasmuch as an operator must know how and where to find a line, the multiple is fixed for all time.

That doesn't necessarily mean that telephone 2859 could not be at one address today and at another tomorrow; this is where the flexibility of the distributing frame comes in. Referring to Fig. 20, is there any reason why 2859 could not be connected to any cable pair in the entire 3000?

38. *The Multiple.*

The multiple jack is a calling jack and as its name implies, is multiplied on the switchboard a sufficient number of times so that each operator can have access to at least one jack. This does not mean that each line has one multiple jack on each position; it does mean, however, that each line has, within reaching distance, a multiple jack either in front of, on the left of, or on the right of, each operator.

In other words, each line would appear in the multiple every third position Take, for instance, 2859, if it appeared on the first position of the board, it would appear again on the 4th, 7th, 10th and 13th positions and so on throughout the length of the switchboard.

Multiple jacks are manufactured in strips of twenty (see Fig. 34). They occupy just exactly half the space, both horizontally and vertically, of an answer-

(Continued on page 43.)

Phantom Circuits and Their Possibilities

By P. KERR HIGGINS

Necessity, "the mother of invention," is responsible for the introduction of the phantom circuit. The writer's first acquaintance with phantom coils was in Scotland nearly thirty-five years ago, when Mr. Dane Sinclair and his associate Mr. Bennet had made up a coil for phantom use. These coils were in use for some time but were not entirely successful. Later, however, they were considerably improved and a practical coil developed.

Need of Phantom Circuits

While materials were cheap, the development of phantoms was slow, but with the rising cost of materials, they became an urgent necessity. When additional circuits were needed, the smaller companies, not having the ready cash to build more lines, were quick to avail themselves of this economical and practical plan. At first the phantom circuits were merely a makeshift but today they are a permanent part of the telephone business. As a matter of fact a well constructed and balanced phantom circuit is equal to any physical circuit.

The phantom coil, instead of being a trouble producer, as some of our trouble men are inclined to consider it, is really one of the simplest pieces of telephone equipment known. However, in many cases the writer has found that a great deal of the trouble is due to lack of suitable protection against foreign currents or to a lack of suitable switches for cutting out the coils during tests. There is nothing to get out of order in such coils, no adjustments are necessary and no moving parts to wear out. These coils properly designed and installed will work anywhere and any time. The only requisite is that the circuits composing the arrangement must be properly balanced; that is to say, that the insulation of the physical circuits must be maintained to the highest possible insulation, that the resistance of the circuits shall be as uniform as practical and possible and that no bad joints and no leakage shall be permitted to exist on the physical circuit. If properly installed and protected, they will last forever.

In Kansas a number of years ago, the writer found phantom circuits built up using a rather crude arrangement, but nevertheless it worked. This consisted of the use of two carbon filament lamps, connected in series at each end of a metallic circuit, a grounded phantom being brought out from the middle connection of the two lamps at each end. Since the physical line had been well transposed and consisted of copper wire, both sides being very nearly balanced, the result was very good considering the crude apparatus used. In the same state, at another exchange, the presiding genius was using two 1,600-ohm ringers instead of the lamp with fairly good results.

Principle of the Phantom Circuit

To understand the principle of the phantom circuit we find it necessary to refer to the law governing the flow of electrical current, namely, "that a current of electricity follows the path of least resistance." Hence, if two wires are of the same length, size and material, the resistance of each will be the same. Now, if a current of electricity of the same polarity be introduced on both wires and a third wire used for a return circuit, there should be no difference of potential at any point along the line. Such a circuit is known as a balanced circuit and this condition should exist on all telephone lines so that transmission of the highest degree of efficiency may be had.

Since a perfectly balanced condition is necessary on the circuits, it follows that all equipment placed on that particular line must also be balanced. This is the objective in the design of all coils to be used for phantom purposes. The current flows over the phantom circuit, beginning at the center of the coil and thence out to each side of the physical line and over the two wires of the physical line in parallel. As this circuit forms only one side of the phantom, it only remains to get the other side off the other physical circuit and connected to the switchboard with the same connections at the other end of the line. In Fig. 1 is shown two metallic circuits equipped with phantom circuit.

A coil for phantom use is made up of four separate windings on a closed core, the resistance of each winding being about 21 ohms. This coil has an impedance ratio of 1 to 1, so that the voice currents are transmitted through the coil in each direction with the same degree of efficiency. Since the phantom circuit is taken off the center of the winding of the *line* side of the coil, there will be the same number of turns of wire and the same resistance on each side of the phantom.

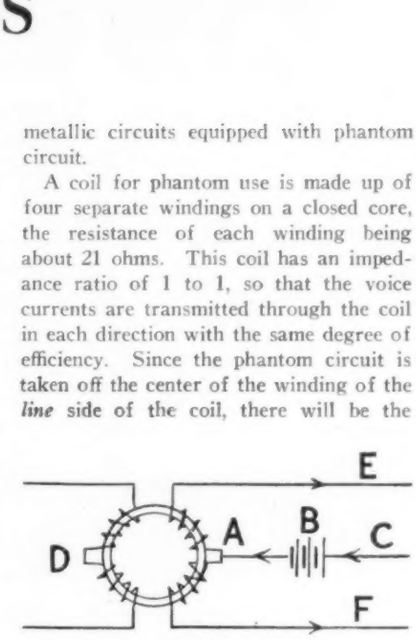


Fig. 2.

The principal difficulty in introducing phantom circuits on the smaller plants is the fear of the lineman or manager that they are entirely too complicated for them to handle. A simplex phantom circuit is extremely simple and easy to understand and a beginner should start with this kind of circuit. It is also possible to use a telegraph circuit on the phantom instead of a telephone, as shown in Fig. 2, *E* and *F* being the telephone line wires and *C* the telegraph circuit.

The phantoming of non-loaded circuits involving as they do the use of repeating coils on the physical circuits, necessarily introduces a certain amount of transmission loss, so that the efficiency of the physical or side circuits is slightly re-

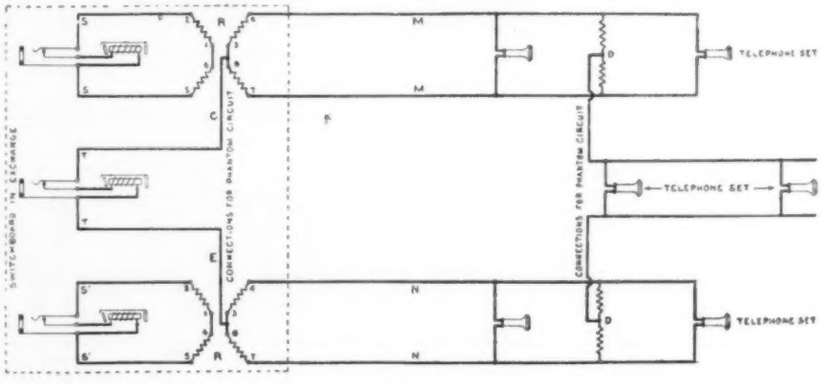


Fig. 1

duced. Nearly all of the long distance toll lines are used for superimposed telegraph circuits in addition to the telephone circuits. In many systems both "simplex" and "composite" arrangements are in use and it is only when such combinations are made that complications in the design of the circuit begin to materialize. In the first of these the two wires of a pair are used in parallel as a telegraph conductor, and in the second case each wire is used as a separate telegraph circuit. An idea of this simplex telegraph circuit may be obtained from Fig. 2, which shows only one end of the circuit, the other end being identical in arrangement.

While the phantom circuit is an economical factor and extensively used by the larger companies, it has not been used by the smaller telephone companies to the extent that it deserves. It will be observed from what has been said that the phantom circuit operates by the introduction of a current on both sides of an existing metallic circuit without disturbing in any material way that circuit. On toll lines this current is introduced by means of a repeating coil but on rural lines a retardation coil is frequently used at the distant end with a repeating coil at the exchange end. This retardation coil is very convenient where a number of telephone sets are bridged across each physical circuit. The use of this is shown in Fig. 3. In Fig. 4 is shown a bank of two repeating coils which is a very convenient arrangement where the phantom circuit is to be a metallic circuit. The efficiency of the retardation coil in rural phantom circuits is such that about ten telephone subscribers' sets of standard efficiency may be connected on each side (or physical circuit) and as many as is ordinarily used in standard practice on a regular rural metallic line may be connected on the phantom circuit.

Great care must be taken in connecting up the phantom coils as different combinations give different results. The coils are usually designed to be connected up in a specific manner. Instructions are usually sent out by the manufacturers and these instructions should be followed out minutely so that the best results may be obtained.

Phantom coils should not be installed on lines that are carried through long cables unless the cable has been specially designed for this purpose. In the early

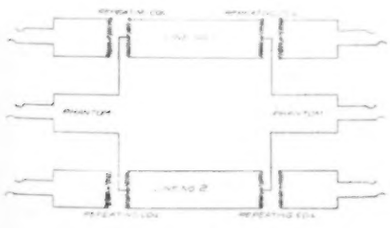


Fig. 3.

days of phantom working, trouble was experienced due to severe electrostatic induction, this being caused by the lines on which the phantom was built not being properly transposed. The matter of transposition and its application to phantom work will be discussed later. It is considered advisable that the ohmic resistance of the lines to be used should be measured and compared and balanced up as nearly even as is possible and practical before the phantom is put in operation. Only the very best type of repeating coils should be used. Their speaking qualities should be very high and also

Fig. 4.

their ringing through qualities and, of course, they must be properly balanced. Cheap repeating coils are usually of inferior quality and design, with a resulting loss in transmission and ringing efficiency. The number of repeating coils that may be placed on any one line is naturally limited due to their effect on transmission and ringing efficiency. The latter depends not only on the number of coils used, but also on the number of stations connected to the line and their location. The question of transmission is an extremely important one and this should be inquired into before purchase, such information being obtained from the manufacturer of the coils.

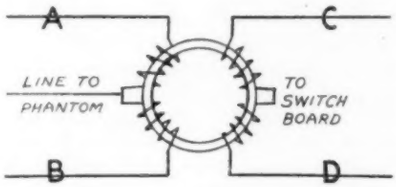


Fig. 5.

Before a phantom circuit is put into operation the lines of which it is composed should be thoroughly gone over, trimming all trees, replacing broken insulators and in every way increasing the insulation of the line. All bad or suspicious joints should be cut out and remade.

Someone has asked why the name "phantom" has been used. Webster's dictionary defines the word phantom as a "spectre" or "an apparition," or in other words, without a physical body. In telephone phantom work one or more circuits is thus obtained without any additional physical wires. It is true that the phantom arrangement is based upon physical conductors, but because there is a clear gain of one or more operating circuits without increasing the number of physical circuits, the term phantom has been applied to any system which accomplishes this object, whether it be simplex, composite or otherwise arranged. The terms "simplex" and "composite" merely refer to different arrangements of phantom cir-

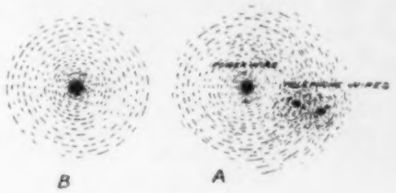


Fig. 6.

cuits and must be studied separately. Where the result is a gain of only one circuit, grounded or metallic, telephone or telegraph, it is called simplex. Composite means the simultaneous transmission of telephone and telegraph messages over a metallic circuit or combination of circuits and the apparatus used to construct such an arrangement is known as a composite set. This apparatus usually consists of repeating coils, impedance (or retardation coils) and condensers. The purpose of the condensers is twofold. One is to prevent a direct current from reaching the coils of the telephone when telegraph is used and the other is to provide a bridge across an open key in the telegraph circuit which is capable of passing alternating or telephone currents to the receiver, for the reason that a condenser is open to direct currents, but permits the passage of alternating currents such as are used in telephony. The purpose of the impedance or retardation coils in the case of using a telegraph circuit is to round off the peaks of the Morse current and also to prevent cross fire through the loop formed by the telephone circuit. By suitably combining condensers and impedance coils, simultaneous telephony and telegraphy is made possible.

Attention is drawn to a very fine sketch showing plan to eliminate noise from transmission lines on rural lines in the TELEPHONE ENGINEER, June, 1925, page 37, which is to be commended because of its simplicity and its direct application to many rural problems. In Fig. 5 is shown a diagram of a phantom circuit with a tap to another line connected to the middle of one physical circuit. This is not always good practice except where a grounded line is to be connected to the physical metallic circuit and if connected only on one side is liable to unbalance the physical circuits. The circuit is shown merely as indicating the attempt of many people to set up combinations without proper forethought and the proper study of the results to be obtained.

Should trouble develop on a phantom

circuit and the lines become noisy and cross-talk, the trouble is nearly always due to a ground, leakage or a cross on one of the physicals, or possibly one side of the physical is open. The following test is suggested: First, test on the phantom circuit, because this can be done without in any way disturbing the lines with the repeating coils in them, and note whether or not the physicals are grounded. If the physicals are not grounded, then the switches should be opened eliminating the repeating coils and making it possible to test each of the sides of the physical circuit or circuits. If a wire chief is available at the other end or some one who can do so, he should be asked to ground both sides of the phantom so that a Varley loop test can be made. This will determine the nature of the trouble and possibly the location. If the trouble is due to an open or a bad joint on one side of the physicals, this may be located by testing each physical separately. Frequently more than one trouble presents itself at the same time, hence it is well to make sure that only one trouble exists at the time of the tests or if more than one exists, to analyze and locate each case separately. The use of knife switches at both terminals, arranged to ground or open the physical lines, is found extremely convenient in making tests and if these arrangements are made the fact that a phantom circuit has been built up on the physicals does not complicate the testing in any way.

The trouble most people experience in phantom work, as previously stated, is not only the fear of complications, but usually the unwillingness of the man in charge to give the matter a few hours' careful study. The returns from such a service from an economical standpoint are simply amazing and the improvement in transmission is very noticeable.

Some Facts About "Cross-Talk" and Noise

In Fig. 6 will be seen the conditions which exist around a conductor when current is passing. Some trouble men with whom I have talked have disputed this statement, and it was necessary for me to demonstrate the actual presence of this electro magnetic field by placing a few inches away from the line wire a magnetic needle and causing current to be passed over the wire, a very simple experiment. This phenomena is known as electro magnetic induction, or, in telephone parlance, "cross-talk" in the case of adjacent telephone wires and a high tension "hum" in the case of adjacent power wires. Where the power wires are a considerable distance from the telephone lines there may also be trouble due to leakage, either direct through the earth or through the moist air or the places producing the leakage. As previously stated, an electric current in seeking its return path travels over the path of least resistance. In grounded circuits the wires leading back to the exchange afford a more open path than the earth for the same or even less distance. Therefore the indirect path is followed when the resistance of the line is reduced by the bells and drops being cut out, for example, when the line is in use. As the current varies constantly, it is usually enough to affect the magnets of the receiver and a humming noise is the result. While metallic circuits reduce or overcome this difficulty, there is still another phase of induction to which they are subject, namely the electro magnetic and electro static induction. In Fig. 7 we are looking at the end of the wire. The light dotted circles around it represent the magnetic field set up around the wire or wires when current is passing over or through them. This condition exists around every wire carrying current and might be understood theoretically as being approximately the same as when a stone is thrown into a body of water, the stone where it enters the water representing the conductor. The direction and strength or number of the lines of force of the magnetic field depends upon the current passing over the wire. In the two wires of a metallic circuit these lines of force are opposite and have a neutralizing effect on each other. Any change of the conditions in the lines within the influence of the disturbed wire changes or destroys the effect to a greater or less degree. Inductive interference is governed by well known laws which we will discuss later.

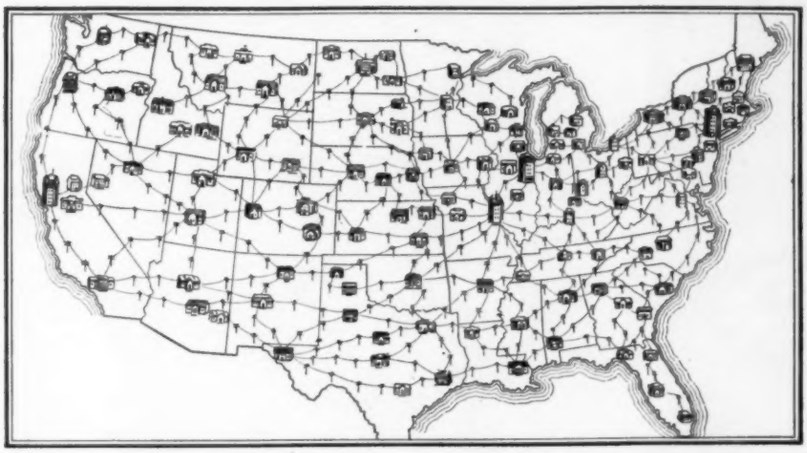
An alternating current does not divide between two branches of a circuit in inverse proportion to their resistance when either branch contains inductance or capacity. Hence we must not only consider resistance, insulation, length and location of circuit, but also inductance and capacity when designing a complicated phantom layout. The loss of transmission current is due to three factors, disregarding the leakage of the line. These are the resistance of the line, the inductance or electro magnetic inertia and the capacity or elasticity of the line. The electrical energy in the talking circuit is transmitted from one end of the line to the other by a form of wave motion. The intensity and variations of the pressure impressed at the transmitting end follows exactly the intensity and law of variation of the exciting force, in this case being what are known as sound waves. Talking currents are constantly changing in frequency, that is, the frequencies of the electrical waves are greater for the higher tones than for the lower tones. In other words the frequency depends upon the pitch of the sounds delivered to the line at the transmitting end. Inductive reactance in a circuit increases with the frequency and the capacity reactance decreases as the frequency increases. Also the capacity reactance increases as the frequency decreases. The resistance of a line and the difference between the inductance reactance and the capacity reactance determine the impedance or apparent resistance of the line to alternating current. The voltage or pressure impressed on the line divided by this apparent resistance will give the strength of the current flowing. It will be noted that this law is very different from that governing direct current. Inductance and capacity depend upon the frequency of the current. For those who care to study formulæ the following may be interesting: The reactance of a circuit containing inductance is represented by the formula $2\pi fL$ where π is a constant which equals 3.1416, L the inductance is expressed in henries and f the frequency of alterations in the circuit. The reactance of a circuit containing capacity is expressed by the formula $\frac{I}{2\pi fC}$ where π and f are the same as before. C, the capacity, represents $2\times3.1416\times$frequency. This law is quite complicated to those not initiated in the higher mathematics. With induction between two or more metallic circuits, it is possible to reduce or completely eliminate interference by a proper set of transpositions applied to the line. Where phantoms are used, special transpositions are introduced at pre-determined points and this matter of transposing will be discussed later.

J. E. Armstrong Re-elected Arkansas President

Little Rock, Ark.—J. E. Armstrong of Russelville was re-elected president of the Arkansas Telephone Assn. E. C. McHaney was re-elected vice president and J. S. Gillespie returned to office as secretary. Intimate discussions of practical problems occupied the attention of the two-day session and presented as feature speakers, L. M. Loring, S. A. Lane, E. G. Greber, division plant superintendent of the Southwestern Bell; J. A. Wommack, president of the DeQueen Telephone Co.; C. H. Moses, general attorney for the Arkansas Light and Power Co., and H. J. Elskens Jr., secretary of the Citizens Telephone Company, Paris.

Abilene, Kan.—A large number of employes of the United Telephone Co. have enrolled for the Kansas State Agricultural College's extension course in public utilities.

Reardan, Wash.—Reardan Telephone Co. has bought by the Interstate Utilities Co.



The Future of the Telephone

IT WAS fifty years ago that Alexander Graham Bell invented the telephone, and yet this anniversary is but a milestone in the progress of telephone development. As the giant oak with its complicated structure grows from the acorn, so a nation-wide system has grown out of Bell's single telephone instrument.

The interconnection of millions of telephones throughout the land, regardless of distance, has not come about easily. It has resulted from a series of scientific discoveries and technical achievements embodied in a telephone plant of vast extent and intricacy. Great economies have already been gained by such technical improvements and more are sure to follow for the benefit of telephone users everywhere.

There are still to come many other discoveries and achievements, not only in transmission of speech, but also in the material and construction details of every part of the network of plant.

The future of the telephone holds forth the promise of a service growing always greater and better, and of a progress—the end of which no one can foresee.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
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BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

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PRESSURE CREOSOTED
YELLOW PINE POLES
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When the greatest strain comes, they do not fail—Experience has proved it—Is there a better test than the storm test?
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LINE AND DESK

POLISHING TELEPHONE SWITCHBOARD PLUGS

Switchboard plugs, if not cleaned frequently, will tarnish and corrode due to perspiration from the operators' hands, causing them to deteriorate rapidly as the slightest amount of moisture is very injurious to the insulation of the plug. Dirty and corroded plugs not only result in a poor, electrical contact with the jack springs when the plug is inserted and a consequent transmission loss, but also cause noise and cut-out trouble. Under ordinary conditions, all plugs should be thoroughly cleaned about once per week. On three conductor plugs special care should be taken to clean the tip and ring contact, and on two conductor plugs the tip contact. The thorough cleaning of the sleeve is of less importance since it has more contact surface. Many times plugs are polished with various kinds of material which contains certain ingredients not only deterimental to the plug insulation, but also injurious to the metal parts of the plug and the tinsel of the cord connected to it. Under no circumstance should liquid metal polish, cleaning powders, sand paper, emery cloth or any other abrasives be used to clean plugs, as they will be damaged in a very short time. In order to obviate damage of this nature, plugs should only be cleaned with jeweler's rouge or some other approved polishing paste prepared especially for cleaning switchboard plugs. Several such preparations are now on the market.

Exchanges of six position or larger, should be equipped with a standard electrically driven buffing machine. Plugs can then be buffed by using jeweler's rouge or other approved paste on the buffing wheel. Care must be taken not to buff the plugs longer than is absolutely necessary to clean their surface, thereby decreasing unnecessary wear to the plug parts. After buffing, wipe plugs with a clean, dry cloth to remove any polish remaining on them. In the absence of a buffing machine, plugs can be cleaned by applying a small amount of paste on a piece of cheese cloth and polishing same with a circular twist, then removing excess paste with a clean cloth. Another very good way is to apply paste to a piece of cotton tape one-half to an inch wide, and about three feet long, fastening one end to the key shelf and holding the other end in the hand. Then take one turn with tape around plug to be polished and with the other hand force the plug back and forth on the tape until plug is polished. After this operation take off any polish remaining with a clean piece of cloth. Care must be taken not to hold tape too tight or tip of plug will be unscrewed.

In the smaller exchanges, plugs can be cleaned very easily and with very little effort by using a red rubber or ruby pencil eraser; the sanded or ink eraser being unsuitable for this purpose.

A very good practice is to clean all plugs thoroughly once each week by one of the approved methods and then wipe them off daily with a clean piece of cheese cloth.

Any of the above means will keep the plugs in first class condition at all times and in all probabilities, will eliminate trouble reports on lines that tests show O. K.

Contributed by Ray Blain.

DO YOU KNOW YOUR WORK?

Do you know your work?

You probably think that a foolish question, yet how many of us do know our work, really know it, its relation to other work being done about us, and the part it plays in the general operations of our company?

There are some men who know only enough about their own work to enable them to get by, who apparently don't want to know any more than they have to. These are usually the men who start each morning with two ideas—one, that pay-day is one day nearer; the other, when will quitting time come.

Such men are lucky if they keep their jobs. If you ask one of them why he does not get ahead he will probably tell you he never had a chance, that opportunity never knocked at his door.

He is right—opportunity will never come to him if he continues in his accustomed ways, because he has never even attempted to prepare the way for opportunity to approach him.

Don't forget that we are responsible for the opportunities that come our way or that pass us by.

Again, there are those men who do the work assigned to them, do it conscientiously but without thought or realization of its connection with other work being done around them. Do they know their jobs? Yes, partly, but not with sufficient breadth of vision. They cannot give maximum satisfaction. They are failing to make the best use of their efforts and they are failing to broaden and improve themselves. They do not co-operate as they should. These men probably represent the average, but being average men their progress in the company will in all probability be no better than that of the average man.

Are you content to be classed among the average men, the men who continue to hold average jobs, who continue to draw average pay, and who wait and take the average chance of an opportunity coming along? Or will you be one of those men who ask themselves: "What is my job—what is its relation to the work of the whole company?" And who, having questioned themselves, very soon ask others who know, with the result that they get the proper perspective of their work, do it in the most efficient manner and learn something of the jobs of the men a step or two higher up the ladder.

Remember, you cannot fill the shoes of the man ahead unless you learn as much as you can about his job, while doing your own work in a thorough, intelligent manner.

It is not necessary that you be born a genius or develop into a brilliant individual, but if you would succeed you must think intelligently and apply your thoughts and energy to your work; you must learn all you can about the business; you must help others when possible to do so without detriment to your own duties; you must invite responsibility; and especially in the telephone business you must have a ready smile.

We all either go forward or backward—there is no middle ground. Why not know yourself, your work and your company, and then apply the little extra effort needed to distinguish you from the average, and to prepare the way for the opportunity that will surely come to the deserving, for opportunity is not a matter of luck, but is usually of our own making.—S. S. Bradford in "The Transmitter."

TITLE: "THE VOICE WITH A SMILE"

Judge: "Are you sure he was drunk?"

Policeman: "Not positive, your honor, but his wife says he brought home a telephone manhole cover and tried to play it on the phonograph."—*Northwestern Bell.*

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ONE man does the work of a gang with this most useful tool—and in less time. Does a better job than any man-power effort. Takes up three and one-half feet of slack without new hitch. Used also for pulling underground cable, or taking up slack for splicing. Invaluable for lifting cable reels and other heavy objects. Write for descriptive matter and prices.

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IT is no exaggeration to say that wherever a contact point controls the operation of any machine, it is the most important single unit in the mechanism. Until it functions, the other parts are just so much inert material. Too much care, then, cannot be devoted to its design, to the alloy of which it is made, to its form and shape and size.

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We have been making contact points for fifty years, experimenting with them, formulating scientifically correct special alloys, adapted to certain types of service. These alloys endow the contact point with ability to deliver the maximum, both in efficiency and durability. Such understanding of the subject cannot be acquired in one decade nor in two. It is the accumulated knowledge of half a century, and it is yours to draw upon, at will.

Test it before you order again.

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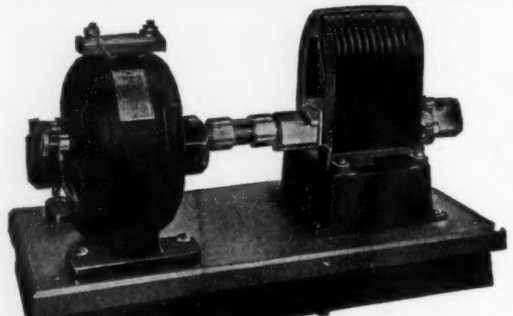

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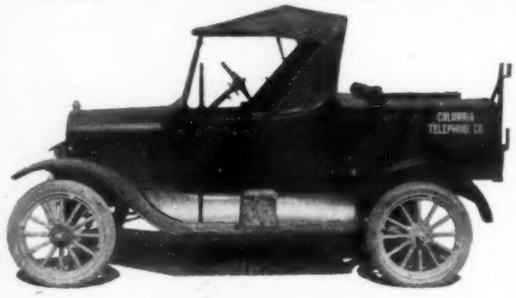
MAGNETO-RINGING MOTOR-GENERATOR

Frees you from the necessity of battery testing and contact adjustments;
Saves the money that must otherwise be spent for battery renewals;
Cuts out the necessity of hand ringing, with its retardation of service;
Insures a uniform ringing current, obviating the complaint of subscribers that their "bells do not ring satisfactorily."

The Holtzer-Cabot Electric Co.
125 Amory St., Boston, Mass. **6161 So. State St., Chicago, Ill.**



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BOOKS ON COMMON BATTERY SYSTEMS

A subscriber asks if we can suggest books on common battery telephone systems describing their working and methods of trouble finding. In reply we can suggest, for his particular use, "Telephony" by McMeen and Miller and the set of five volumes by Jay G. Mitchell on "Telephone Principles and Practice." Rereading of the articles published in recent numbers by John M. Heath on "The Unit Line" will also prove helpful. There are other excellent books, but the ones suggested seem to fit the case best of any we know.

In the matter of books on trouble finding, it is rather difficult to make recommendation. Trouble finding in any type of system is made up of two things, knowledge of the principles of the systems and of the various parts, and experience in actual trouble work. The experience will come if the principles are understood and so the best recommendation we can make is to study the principles of the circuits until they are mastered and work out this knowledge in the every day work of clearing trouble.—Staff Contribution.

At 122 places in this tangle of traffic cord wear gets a chance at your profits

As we make cords we always bear in mind a picture like the one above of the tangle of traffic at a switchboard. It serves to keep us constantly reminded of the abrasion, jerking and twisting that a cord must undergo.

So every Runzel-Lenz cord that is made goes through the most complete laboratory tests in the raw material and finished states that we may be able to present to the telephone industry the longest lived cord for any switchboard.

Put Runzel-Lenz cords to a competitive test anywhere; their inbuilt superiority will be revealed by superior service.

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ACCIDENTS CAUSED BY THE SLIPPING OF WRENCHES

One of the more common of minor accidents in telephone construction work is the slipping of wrenches. In a recent number of *The Travelers Standard*, a number of causes of this type of accident are enumerated. Some of the commonest causes are the following. (1) the use of open end wrenches which are not the right size to fit the nuts to which they are applied; (2) the corners of the nuts may have been rounded out or the jaws of the wrench may have become misshapen through long continued use; (3) monkey wrenches are applied with the jaws pointing away from the users instead of toward them; (4) the adjusting mechanisms of monkey wrenches and pipe wrenches may have become worn so that it is no longer possible to set up the jaws tightly; (5) the attempt may be made to use a monkey wrench or an open end wrench when a wrench of some special type is called for on account of lack of clearance; and (6) the wrench that is used may be too big for the job or it may be unreasonably lengthened by slipping a piece of pipe over the handle so that bolt twists off under the excessive leverage that is applied. In order to stop accidents, it is necessary to eliminate the causes and the methods of doing this are fairly evident in connection with the example cited.

"BUGS WE HAVE SHOT"

A few days ago, a new telephone was installed on a grounded line and seemed to be working O. K. when tested with the installer. A day or so later it was reported in trouble—could not ring, or get rings, or be heard very well. I went out to clear the trouble and found the instrument O. K. but could not get anyone and it seemed to be dead when connected to the line. I started looking for the trouble and concluded it must be the ground connection. I finally found that the ground rod had been driven near the foundation of the house where there was an old cistern and that it had gone through about a foot of earth and then through the roof of the cistern. It was a wet day when the telephone was installed and so it worked then but the earth dried out a day or so later and neither it nor the air in the cistern made a good ground connection.—Contributed.

Okonite Company Tells of Splices and Tapes

New York City—"Splices and Tapes for Rubber Insulated Wires" is the title of an interesting and practical booklet recently issued by the Okonite Company. A copy of this booklet may be obtained free upon request at any of the Okonite Company offices.

Monarch Men Advanced at Annual Meeting

Chicago, Ill.—After a year of marked progress the annual meeting of the Monarch Telephone Mfg. Co. re-elected as directors H. L. Gary, C. A. Bennett, H. L. Harris, L. Q. Trumbull and W. F. Benoist. Officers elected are: H. L. Harris, president; W. F. Benoist, vice-president; L. Q. Trumbull, secretary and treasurer; V. E. Chaney, assistant secretary-treasurer; and J. P. Hauck, assistant secretary-treasurer.

The election of Sales Manager L. Q Trumbull to the position of secretary-treasurer was followed by the appointment of R. G. Faulhaber as sales manager to relieve Mr. Trumbull of some of his duties.

In 1908—Faulhaber is now but 33 years of age—the new Monarch sales manager entered the telephone field with the Dean Electric Co. He was with the Dean company for five years, serving in various capacities until he was transferred to the Kansas City branch of the Garford Mfg. Co. (successors to the Dean Electric Co.), and made assistant to the branch manager. During this time he gained his first traveling experience and later was made sales representative for the Garford company in the state of Kansas.

In 1916, when the Garford company was absorbed by the Stromberg-Carlson company, Mr. Faulhaber moved to Chicago for a short time and became special representative for the Stromberg-Carlson company in charge of sales of Garford apparatus. Later he returned to Kansas City, remaining with the Stromberg-Carlson company until 1918.

Conrad Receives Morris-Liebmann Memorial Prize

Pittsburgh, Pa.—The Morris Liebmann memorial prize, awarded annually by the American Institute of Radio Engineers for the most important contribution to radio progress, was presented to Frank Conrad, assistant chief engineer of the Westinghouse Electric and Manufacturing Company at the annual meeting of the society in New York on January 18 in recognition of his work in short wave development.

Lincoln's Book Fine Guide in Business English.

"Better Business English," a manual for employes of the Lincoln T. and T. Co. which was compiled by H. F. McCulla, commercial engineer of the company, is worthy of general circulation by a number of other telephone companies among their employes. The Lincoln book lays down the principles for favorable representation of the company by its employes, with word of mouth and by letter. The booklet consists of ten pamphlets that were issued periodically among the Lincoln employes. The titles of these pamphlets are: Rising Standard of Business Correspondence, Building a Vocabulary, Words That Need Watching, Correct Pronunciation, Effective Sentences, Correct Sentences, Dead Letters, Live Letters, Correct Form in Business Letters.

Each of the subjects is handled in a manner that impressively gets the message across to the reader. It is a gem of its kind and should find wide favor in the telephone industry. The book has been copyrighted and is available for general sale to telephone companies. Further details may be had upon request, from H. F. McCulla, commercial engineer, Lincoln T. and T. Co., Lincoln, Neb.

Jacksonville, Fla.—Southern Bell Telephone Co. will spend $9,500,000 in Florida extensions during 1926.

Glendale, Ind.—J. W. McCraney and Frank A. Swickard of Alfordsville have bought the local telephone plant from the estate of F. D. Grismore.

Hinton, Okla.—Frank W. Hukill, cashier of the First National Bank, has bought the local telephone exchange from A. G. Carlisle for $15,000.

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for your next convention

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Only 40 miles from the center of population of the United States. The recently completed new wing of the fire-proof, modern French Lick Springs Hotel building includes a well-ventilated ground floor, daylight convention auditorium of 1500 seating capacity, giving this hotel first place among America's convention sites. And, for those who wish, the health-giving waters of the Pluto, Bowles and Proserpine Springs.

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Use the Everhot for branding your new poles and crossarms while they are in the yards, as well as for branding your standing poles. Branding your poles in the yard protects you against confusion as to ownership when they are delivered ready to raise. At the same time it marks your poles for future identification. The company name and identification number branded into these poles make it easy to issue working orders, telling linemen just where to make repairs.

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TREE TRIMMER

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Write for complete details of this money- and time-saver.

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James T. Maguire, California Chief, Killed in Car Crash

Bakersfield, Cal.—James T. ("Jimmy") Maguire, president of the Kern Mutual Telephone Co. and one of the Pacific Coast's prominent national figures in the telephone industry, died at Mercy Hospital from injuries incurred when his automobile turned over on the Taft-Bakersfield highway. Mr. Maguire, prior to heading the Kern company, was construction superintendent for the Pacific T. and T. Co. in San Francisco, Eureka, Oakland and Santa Barbara districts.

Raftery and Daugherty Buy Control of Bunnell & Co.

New York City—Control of J. H. Bunnell and Co., founded in 1879, one of the foremost manufacturers of high-grade telegraph apparatus, fire alarm apparatus and other electrical equipment, has been acquired by J. J. Raftery and J. G. Dougherty. Mr. Raftery, who has been elected president, is well known in the electrical industry. Immediately after graduating from Amherst College he entered the employ of the Western Electric Co. where, for several years he was in charge of sales in the Eastern district. Later, he was eastern general manager of the Manhattan Electrical Supply Co. Mr. Dougherty, who will be a vice-president and treasurer, comes from Bethlehem, Pa. He has been connected with the Illinois Steel Corp. and is a graduate engineer of Lehigh University. The new interests bring to this firm young blood and experienced management. The retiring president, Mr. J. J. Ghegan, associated with Bunnell for 40 years, will retain a financial interest and will continue to give to it the benefit of his long experience. Plans are being made for enlarging the business.

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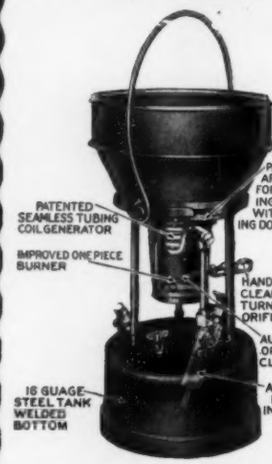
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Western Elec. Co. No. 305 type hotel sets with 2- or 3-bar Generators, 1000 or 2500 ohm ringer equipped with No. 250 Transmitters and 122 Rec. Can supply the above with Biased attachment on ringers without extra chg. @	6.50
Western Electric No. 250 Transmitters complete with mouthpiece and back @	1.35
Kellogg Local or C. B. Transmitters, complete with back and mouthpiece @	1.10
Stromberg-Carlson No. 896—4-bar, 1600 ohm Bdg. compacts @	8.50
Stromberg-Carlson No. 599—4-bar, 1600 ohm Central checking Bdg. compacts @	7.25
Stromberg-Carlson No. 599 type 4-bar 1000 or 1600 ohm Bdg. compacts @	7.00
Monarch 3-bar, 1000 or 1600 ohm Bdg. compacts @ $7.00—4-bar $7.50—5-bar @	9.00
Garford Pony type 4-bar, 1000 or 1600 ohm Bdg. compacts @	8.50
Am. Elec. No. 36 3-bar 1000 or 1600 ohm Bdg. compacts @ $6.50—4-bar @ $7.00—5-bar @	7.75
Kellogg No. 2805, 3-bar, 1000, 1600 or 2500 ohm Bdg. hotel sets @	7.00
Dean or Garford 3-bar, 1000 or 1600 ohm Bdg. desk sets @ $8.75—4-bar @ $9.25—5-bar @	10.25
Monarch 3-bar 1000 or 1600 ohm Bdg. desk sets @ $8.50—4-bar @ $9.00—5-bar @	10.00

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Automatic Makes Great Progress in Germany

Berlin, Germany—Despite the financial difficulties attending the introduction of new methods by the post office authorities, the introduction of the automatic telephone system has made rapid progress in Germany, says the Electrical Review. A beginning in this respect was first made in 1907 by the conversion of the Hildesheim network to the automatic system, but further work was interrupted by the war and in the three years immediately following, and it was only possible to make a fresh start in 1922 in a systematic manner.

The aim of the postal authorities now is to completely transform the local networks within a period of 15 years. At present in the old Reich telegraph area there are 33 large exchanges with 105,000 automatic connections, 29 medium exchanges with 10,000 automatic connections, and 113 exchanges with 8,000 such connections, and preparations are being made for the conversion of a similar number of other exchanges. The course of the financial position will determine whether the 15 years' program will be entirely carried out.

Carrier Current Equipment in Australia

Sydney, Australia—Carrier telephone equipment, furnished by the International Standard Electric Corporation, was installed recently between Sydney and Melbourne on a 600-mile circuit and provides three telephone channels in addition to the existing telephone and telegraph circuits. The successful operation of the new facilities is attested by the fact that within a very short time after they were made available to the public, traffic increased thirty per cent and connections were completed on the average in about seventeen minutes.

The most recent order which International Standard has received from Australia calls for five channels each of Carrier Telegraph equipment, between Sydney and Melbourne and Melbourne and Adelaide. The lengths of the circuits are approximately 600 and 500 miles. To provide for the signals reaching their destination with sufficient strength, repeater equipment for amplifying the high frequency currents will be installed at intermediate points on both circuits.

Alma, Ark.—Henry Weese has purchased the local telephone exchange from C. B. Stewart.

Richmond, Kan.—Alice McCandless Nofsinger has bought the Richmond Home Telephone Co.

Grandview, Ark.—The local telephone system is being rebuilt.

H. E. Bradley Picked to Lead Quaker State Independents

Harrisburg, Pa.—H. E. Bradley of Harrisburg was elected to head the Pennsylvania State Telephone and Traffic Association by the association's board of directors. Other officers elected: Vice-president, Eastern district, J. F. Stockwell, Philadelphia; vice-president, Western district, W. S. Paca, Oil City; secretary-treasurer, Cameron L. Baer, Harrisburg.

Directors elected—Eastern district: J. F. Stockwell, Philadelphia, chairman; G. B. Rudy, Sr., York; H. A. Oberdorf, Columbia; Cameron L. Baer, Harrisburg; J. R. Bailey, Williamsport. Western district: W. S. Paca, Oil City, chairman; J. H. Wright, Meadville; J. Z. Miller, Erie; K. B. Schotte, Kittanning; E. D. Schade, Johnstown.

Directory Publishing Company Organized by H. A. Johann

Shidler, Okla.—H. A. Johann, manager Shidler Telephone Co., has organized the O. K. State Directory and Publishing Co. at Shidler. He will continue in the telephone business, but will also publish telephone directories and do other printing for public utilities.

Partridge, Kan.—R. W. Vest has bought the local telephone exchange from C. H. Burke.

Bellevue, O.—As a result of the Medina and Brunswick plants the Kapp interests' exchanges in Ohio now number 21.

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Approved by Large Operating Companies For the Following Strains

6" 2-way	2,200 lbs.
6" 4-way	6,000 lbs.
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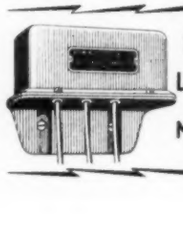

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MINNEAPOLIS, MINN.

George Kirkham, American Steel and Wire Agent, Retires

Memphis, Tenn.—George D. Kirkham, who has been sales agent for the American Steel and Wire Co. at Memphis since 1902, retired December 31, to take life easy.

Mr. Kirkham entered the wire business with the Washburn and Moen Mfg. Co. in 1886 and came with the American 27 years ago when it bought the Washburn and Moen company. He is active in the business and social life of Memphis and also has a wide circle of friends in the north.

Worcester, Mass., Gets First Graybar Branch

Worcester, Mass.—A new distributing branch house of the Graybar Electric Co. has just opened its doors for business at 50-52 Portland street, Worcester, Mass. W. A. Searle has been appointed sales manager of this branch, which was opened by the Boston Supply House.

Biloxi, Miss.—Cumberland T. and T. Co. is to erect a new exchange building here.

UNIT LINE TERMINUS

(Continued from page 31.)

ing jack and its associated line lamp, but an answering jack and line lamp appears only once on a switchboard for each line, while a multiple jack may appear many times, depending on the size of the office.

Multiple jacks are piled and bolted in the switchboard in banks of one hundred (see Fig. 35) and strange to say these banks are numbered from top down rather than from bottom up; however, from bottom up is the normal way of growth of the switchboard.

The unit line (Fig. 20) would have a multiple jack approximately every third position throughout the length of the switchboard and assuming a 3,000 line board, the multiple of each line would appear about 10 times.

Figure 36 illustrates the multiple jack principle, i. e., it shows how the multiple jacks from a line recur about every third position throughout the switchboard.

WANTED—A copy of TELEPHONE ENGINEER for August, 1925. Will extend your present subscription two months for same. Address TELEPHONE ENGINEER, 28 E. Jackson Blvd., Chicago.

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Minnesota's Big Convention Elects E. P. Wright President

St. Paul, Minn.—E. P. Wright of Alexandria was elected president of the Minnesota Telephone Association to succeed the late D. M. Neill of Red Wing, at the 17th annual convention of that body. High tribute was paid to the memory of the lost leader during the convention session. Other officers elected were: C. M. Smallwood, Worthington, vice-president, and J. C. Crowley, secretary-treasurer. During the course of the meeting Crowley was the subject of many commendatory remarks because of his valuable service in handling the problems confronting the association's members.

Minnesota's telephone men conducted an exceedingly profitable three-day session of consideration and research. Members of the organization, in telling of their work during the past year, gave vivid evidence of the progress that Independent telephony is making under the able management with which that state's companies are blessed.

The state's telephone companies have had some tough battles to go through in legislation, and are not finished with the campaign, according to Mr. Wright's presidential address. He told of the necessity of fair legislation with respect to rates and inductive interference in particular. He stressed the importance of co-operation between rural companies and the larger units and brought out the association's need for more money to enable it to handle the demands of the smaller companies that must inevitably fall upon it. Successful results of the district conferences also were summarized in the Wright address.

Inductive interference occupied a prominent spot in the remarks of J. E. Wright, Minneapolis division commercial agent of the Northwestern Bell, who presented an illustrated address on "Some Things to Consider in Order to Meet Our Responsibilities to the Public." Mr. Wright brought out details of preventative maintenance, toll relations, accounting methods and public relations, especially as concerning the farmer, during the course of his remarks.

A. C. Cragg, the Tri-State's general auditor, who has been one of the moving factors in the national association's accounting committee, reported in illuminating detail the accomplishments of this committee and analyzed the committee's findings. He expressed hope that the accounting handbook being prepared by this committee would greatly simplify and standardize correct telephone accounting practices. He said that if the Minnesota association carries out its plan of comparing figures and operating practices at the district conference, much practical good will come of the venture. J. W. Howatt, the Minnesota commission's supervisor of telephones, also spoke on accounting, urging the necessity for correctness of method and accuracy in recording the expenditures for new plant as well as the retirements for plant removed, abandoned or replaced by relating instances of apparent errors in accounting as revealed by audits of books and examination of reports of telephone companies.

Jay Greaves, Glencoe, put forth the report of the association's committee on inductive interference, which showed decided progress in reducing this fertile source of trouble in Minnesota. He told of the ruthlessness of some of the power companies and noted an improvement in this situation when the larger power utilities began to command the field. The history of the telephone association's successful fight in the legislature was recited. The rules compiled for the government of the interference problem would serve as a text book for the conflicting interests to employ in solving their perplexities without being compelled to go to the commission. A lively discussion followed the reading of the report.

Harry C. Scoles, traffic engineer for the Tri-State, spoke on the importance of peg-count and traffic studies, paying marked attention to the value of these studies in the small exchange. His interesting and helpful address was well received.

Utility financing requirements were explained by J. L. Seybold of Wells-Dickey Company, Minneapolis, in a way that offered considerable help to the telephone man who had some financing in prospect. The financier outlined as necessary requirements for the telephone companies intending to finance: "A business unit of such size and adequacy as to permit a distribution of overhead and still show a return on the investment, a capable management and a proper set of books."

G. W. Robinson, president of the Tri-State, compared the history of the telephone industry with the history of the United States. "First we had," said he, "the era of monopoly and restriction. Second, the era of awakening and protest. Third, the era of contest and battle. Fourth, the era of construction and progress."

Among other headliners who spoke briefly during the convention sessions were C. C. Deering, national association secretary-treasurer; Thomas Phalen, secretary of the South Dakota association; Fred Runkel of Portage, Wis., and A. J. McInnes of Valley City, N. D.

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Telephone Harrison 7848

A. J. Johnson Company's Specials Prove Guide to Shoppers

Chicago, Ill.—Monthly "specials," a list of construction supplies and other equipment which is being sent out each month by the A. J. Johnson Co., is becoming generally recognized as a valuable help to telephone companies that are shopping for attractive prices on standard material, according to Al Johnson, head of the company. Johnson's extensive experience as a purchaser is employed in securing these monthly leaders on the shopping list. The "specials" include a wide range of supplies that are handled by Johnson in addition to his line as distributer of Superior friction and rubber tapes, Victor and Ace dry batteries, radio B batteries and other standard items.

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J. K. Johnston, Telephone Engineer

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BARTLETT TREE TRIMMERS faithfully guard the lineman from those high tension wires that lurk with murderous intent among the branches. It's easier, too — much easier—to trim with the **BARTLETT**—a compound reason why you should use them.

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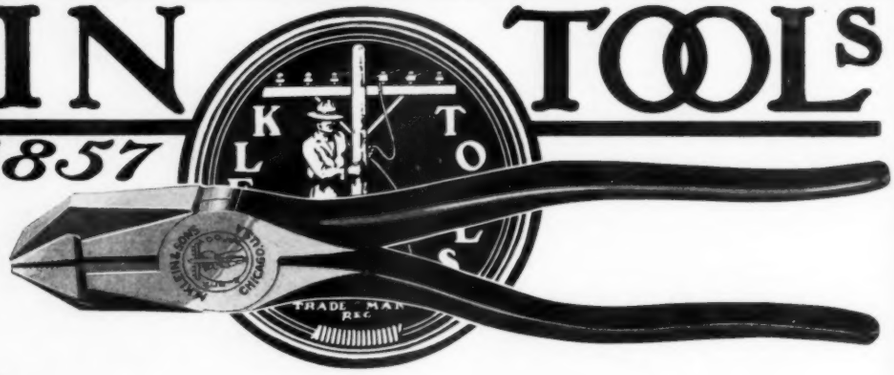

Mathias KLEIN & Sons Established 1857 Chicago Ill. U.S.A.

Quick Change With Monarch New Board

Chicago, Ill.—The Monarch Telephone Mfg. Co. has developed a new combination magneto and common battery switchboard. The illustrations on this page show it in one case as a magneto board, and in the other as a common battery board. The magneto board, with an ultimate capacity of 320 lines, when converted to common battery, has an ultimate capacity of 400 common battery and 120 magneto lines.

This magneto board is one of the new type Monarch switchboards having lamp supervision and new-style, key-shelf equipment. When converted to common battery it has all the desirable features required for the size exchange this board is intended to serve. The big advantage of this Monarch combination switchboard, it is stated, is that the magneto board does not have to be rebuilt in any way for this conversion. At the time the magneto board is built, space is provided and arrangements are made for the additional equipment required for the change to common battery.

In converting this board from magneto to common battery service, the key shelf and all permanent wiring remains the same. The lamp supervisory cord circuits are made universal simply by adding two relays on mountings already provided on the relay gates in the rear of the cabinet. The drops and jacks are replaced with lamps and jacks, for local lines, which are mounted with fasteners already provided for this purpose. Line cables and relay bays specially made for this conversion are furnished by the Monarch company at the time this change is made.

The object of this switchboard is to provide a means for easily changing service from magneto to common battery in the quickest and most economical way at any time during the life of the board. It is stated that this combination magneto board now can be installed at magneto prices and in five or ten years, when it is necessary to convert it to common battery, the investment will be no greater than if the board had been equipped with common battery lines in the first place.

The Monarch company claims that with this switchboard operating companies have a most satisfactory method of keeping pace with the growth of their cities for the full life time of the board.

Meckler, Matthews' New Gotham Boss

Louis M. Meckler has succeeded W. J. McIlvane as New York representative of the W. N. Matthews Corporation, St. Louis, manufacturers of Matthews Electrical Specialties. Mr. Meckler formerly was employed as a technical assistant in the Electrical Testing Laboratories, New York City, and later was chief inspector of electric equipment on the Hudson and Manhattan Railroad trains. He then entered the Engineering Department of the Public Service Electric Co. at Newark, N. J., working on substation construction, and while there qualified for the position of Electrical Engineer for the New Jersey Public Utility Commission, which position he held for nine years. He then spent two years in the office of John S. Ware, Distribution Engineer of the Public Service Electric Co. of Newark, and in April, 1925, became sales engineer of the W. N. Matthews Corp. in the New York metropolitan area. When Mr. McIlvane resigned, he was appointed New York representative.

The Baltimore territory, formerly covered by Mr. McIlvane, will be under the supervision of H. C. Biglin, Southern District Manager of the W. N. Matthews Corp., and the territory will be covered by J. J. Smith with headquarters in Baltimore. J. T. Pearson, district manager in Detroit, has resigned, and the Detroit territory will be covered by H. L. Brueck, Chicago District Manager, while the Iowa territory, formerly covered by Mr. Brueck, will be covered by W. M. Watters. The northern section of Pennsylvania, formerly covered by the Matthews New York office, has been transferred to J. A. Jaques of the Pittsburgh office.

Louis M. Meckler

Omaha, Neb. — Northwestern Bell plans to spend $1,500,000 in the Nebraska division in 1926.

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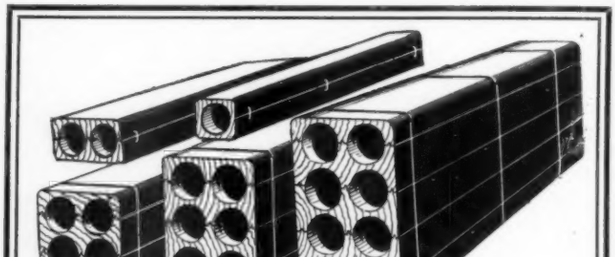

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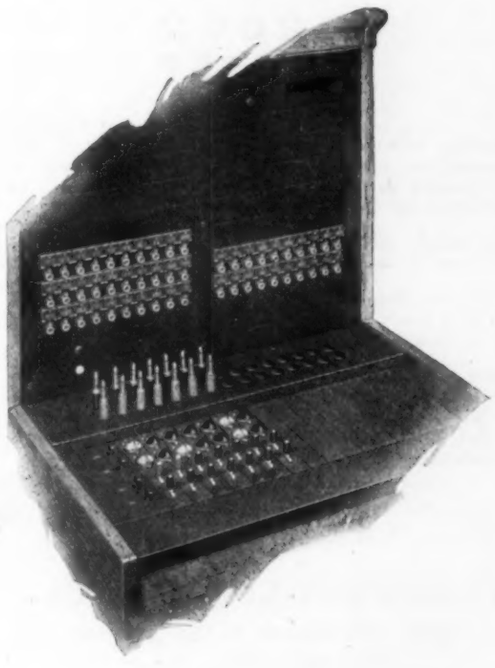
THIS magneto board, with its new key shelf supervisory key and signals, brings to the small town and rural districts magneto operator efficiency equal in practically every respect to the common battery operation in metropolitan districts.

Several new features and newly designed parts have been employed in building this board, making it more reliable and efficient in operation. The new key shelf supervision has two clearing out signals, a ringing and listening key and a ring back key combined in a single unit. The two clearing out signals are linked together mechanically with the listening key. If the signals are open, throwing the listening key into supervising position automatically restores them.

The close up view of the keyshelf of this new magneto board shows clearly the arrangement of this new supervision. The signals are no longer hidden behind a tangle of cords. The key shelf and plug board is covered with a solid black insulating material that will not warp or crack. The pure white signals stand out in strong contrast against the black.

This Monarch Magneto Switchboard is carried in stock, and equipped as follows:

Code No.	Lines Wired	Lines Equipped	Cord Equip. Wired	Cord Equip. Equipped
5001-A	50	30	15	6
5001-B	50	50	15	8
5001-C	100	80	15	10
5001-D	100	100	15	12
5001-E	150	120	15	15



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Get complete details of the Peerless T-2002 Test Set and you'll see right away why it is far ahead of anything else for your work.

We will be glad to send you information of other Thompson-Levering instruments for the telephone industry, also. These instruments include portable testing sets, cable testing apparatus, and standard electrical instruments.

Have you ideas about some electrical instrument you'd like to have made? Take up the matter with us, for we have splendid facilities for manufacturing in this line.

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